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MAROONED

BY MARTIN CAIDIN

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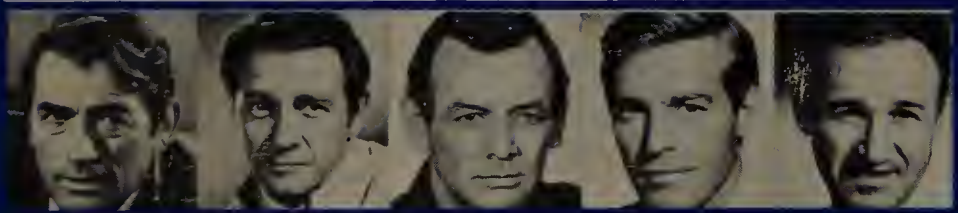
JAMES FRANCISCUS AND GENE HACKMAN,
SCREENPLAY BY MAYO SIMON



THE MEN OF
MAROONED

JAMES PRUETT He was threatened with the loneliest death any man has ever had.

CHARLES KEITH His was the awesome responsibility: could he gamble with an entire space program in the hope of saving three men?

JIM DOUGHERTY Did he have a chance of rescuing his buddy, or was he throwing his own life away in a meaningless gesture?

COSMONAUT-COLONEL ANDREI YAKOVLEV His orders were clear: get to the astronauts, get to them b e f o r e they do!

MAROONED

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DAVID JANSSEN as
Ted Dougherty
JAMES FRANCISCUS
GENE HACKMAN

in

MAROONED

Co-starring
LEE GRANT NANCY KOVACK MARIETTE HARTLEY

Screenplay by
MAYO SIMON

Based on the
novel by MARTIN CAIDIN

Produced by
M. J. FRANKOVICH

Directed by
JOHN STURGES

Panavision®
Technicolor®

MAROONED

A NOVEL

BY MARTIN CAIDIN

Specially revised for this edition

Screenplay by MAYO SIMON

CORGI BOOKS

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MAROONED

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This book is for

Pete Conrad
Dick Gordon
Al Bean

Golden Wings to the moon . . .

Author's Note

Marooned is becoming a book with a history of its own.

The story as told originally involved two spacecraft systems that have now passed into the still young but swiftly moving history of manned space flight. These were the *Mercury* spacecraft of the United States and the *Vostok* of the Soviet Union, each machine accommodating a single astronaut. At the time of its writing *Gemini, Voskhod, Apollo* and *Soyuz* did not exist. In the interval since, *Gemini* and *Voskhod* have also become part of that historical past, and the stage is now occupied by *Apollo* and *Soyuz.*

The story told in *Marooned,* when it was written in 1963, involved meticulous attention to its technological framework —the authenticity of programs and hardware, the reality of situations, and the rigid requirements of orbital laws and mechanics. Much of the book was the direct result of my long association, as a government consultant, newsman, broadcaster, with Project *Mercury* and with what was at the time the still embryonic program of *Gemini,* and related programs. Close association with activities since 1950 at Cape Kennedy, active participation through a wide spectrum of actual flight —these and similar events are all vital to the story. I took no liberties with the technicalities of the American and Soviet manned space flight programs which formed the basic framework for *Marooned.* Indeed, quite the opposite; I remained wholly within the restrictions of technical fact. No better accolade could have been bestowed on the book than the com-

mendation in *This New Ocean,* the official NASA history of Project *Mercury,* in which *Marooned* was recommended to the reader for its comprehensively accurate portrayal of what went on behind the scenes in the manned space program.

Marooned would have been impossible in its final form without the assistance of many people in making the background and technical details so very real. Astronaut Wally Schirra told me he could find but a single technical flaw in the entire story, but has refused to divulge this gem on the ground that it keeps him always one up on the writer.

Thomas F. Heinsheimer, a brilliant young scientist, one of the designers of the *Mercury-Atlas* abort system (ASIS), and at the time a member of the design team for *Apollo* guidance at the Massachusetts Institute of Technology, worked many hours with me to establish the accuracy of actual and created orbital events in the novel; the results of our labors were subjected to the scrutiny of leading engineers, and to electronic computers.

I was then, and remain, grateful to the personnel of the National Aeronautics and Space Administration—most especially the Goddard Space Flight Center in Maryland, the Launch Operations Center at Cape Kennedy, the Office of Information Services in Washington, and the Office of Public Affairs of the Manned Spacecraft Center in Houston. I am indebted to the McDonnell Aircraft Corporation (*Mercury* and *Gemini* spacecraft), which is now McDonnell-Douglas, for their invaluable assistance; to friends at the many schools and research centers for aerospace medicine within the United States Air Force.

And most especially to a man who was found in the book as he is in real life—Ed Lyons, close friend, tutor, and brilliant airman. All these, and many more, provided the substance out of which came *Marooned.*

Then began the new chapter in the history of the novel itself.

Shortly before publication by E. P. Dutton and Company in May, 1964, the motion picture rights to *Marooned* were acquired by Mike Frankovich, who began a five-year effort to produce for the screen a story with the unyielding demands of accuracy that characterized the book.

During this period many people have given unstintingly of themselves to produce what is unquestionably now—and, I do

not doubt, for some years to come—the finest portrayal of the dimensions of our space program.

As the years and the many millions of dollars multiplied in this all-out enterprise, the efforts of many people under the guidance of Mike Frankovich began to bear their certain fruit. Frankovich, of course, was with the project from its very inception and wielded the master's hand in sustaining the continuity. John Sturges, as he has so many times in the past, contributed his brilliant direction and an extraordinary sense of "feeling" for the story he brought to unfold before his cameras. The writer is only too well aware of this from first-hand experience, for which I was grateful. Frank Capra, Jr., as associate producer, spent many hours with the writer in bringing this story from print to camera.

But in any event of so exhaustive a need for coordinating many thousands of individual efforts, one man always stands out—and I spent many hours with that man in his office and on the set. If the author creates the original story, the producer is the man who creates the final product you see on your motion picture screen. Throughout every moment of the motion picture it was, and remained, a rigid and inflexible requirement that under no conditions would authenticity, accuracy, realism, or reality in any way be compromised. As producer of *Marooned,* Mike Frankovich made a decision that in coming years will bear its own special fruit. Looking into the future, as the story was modified to pace the times, basing his decision on a projection of reality, Mike Frankovich opted that the crew of *Ironman One,* in the motion picture, should be three men who had spent several months within an orbiting laboratory made up of an *S-IVB* spacecraft. Recently, the decision was made by the National Aeronautics and Space Administration to commit to an *S-IVB* orbiting laboratory, to be launched in the latter months of 1972. The booster for that first great station will be *Saturn V* Launch Vehicle #514—an eloquent testimonial that *Marooned* must be wholly accurate in terms of today and of tomorrow. For that decision I tip my hat to Mike . . .

Out of this effort and the motion picture it achieved, the new *Marooned* was to be created. Those involved in its planning were the people just mentioned, and Marc Jaffe of Bantam Books, who had some years back pressed this writer to commit for the original story.

The issue was quite clear. The film, to keep pace with the development and the future of manned space exploration, would be updated from *Mercury, Gemini* and *Vostok* to *Apollo, Apollo Applications, Soyuz,* and the *X-RV* (the orbital version of the *X-24A* lifting body spacecraft). Why not the book as well? Could we not equally adapt the original *Marooned* to the newer story?

Mayo Simon, who wrote the screenplay, did a superb job. This writer has read many hundreds of screenplays, and none compares with the reality, depth and feeling accomplished by Mr. Simon. He deserves all our plaudits, and has already had my own personal ones.

Now for the new story of *Marooned.* It was rewritten from first page to last. It is the same story but written as though I were writing it today. Whenever possible I have conformed to the version you will see on the screen.

To those who already know the novel, I hope these pages will be even more exciting than the earlier ones, yet as faithful as the original in every particular to every known aspect of manned space flight.

MARTIN CAIDIN
Cape Kennedy, 1969

This is a book of fiction; its plot is the product of its author's imagination. This plot is unique in that it concerns an imaginative orbital mission of Apollo Applications—a flight that is yet to be flown—as well as other experimental and space programs. Owing to the nature of the plot, certain living people, most of whom carried out actual flights in Mercury, Gemini or Apollo, or were otherwise associated with these programs, are referred to in the story by their real names. All other characters in the novel, however, including any who may in certain cases occupy posts that have actually existed or do now exist, are wholly fictional. Any resemblance between them and any actual person or persons, living or dead, is purely coincidental.

Chapter I

He tried to avoid thinking, to still his mind. Coming out of a deep sleep, he struggled to force himself back into its comfort.

He lay absolutely quiet, his eyes closed. But his mind was a persistent intruder which defied his attempts at silence. Yet, he tried.

In the stupor of grasping at sleep, his thoughts were hazy and muddled. For a long moment he did not know, could not remember where he was. How had he come to be in this incredibly soft and comfortable bed? He allowed his thoughts to trickle slowly upward from his mind like small bubbles rising in a pool. He permitted his senses almost one by one to pierce the haze and to become alert. Yet stubbornly, he kept his eyes closed.

He felt no pressure upon his body, so comfortable was his bed. He marveled at this, but even as he did so he strained to hear sounds about him. Slowly they pressed upon his mind. Yes, there *were* sounds.

For a moment he believed himself to be aboard a ship—a ship at sea, sliding effortlessly through a calm surface. The sounds . . . he listened to a subdued humming. It was a background noise. It did not intrude upon his thoughts, but when he listened for it carefully, it came to him clearly. Other sounds of machinery filtered into his thoughts. There was a vibration, so slight as almost to be more felt than heard. He sharpened his thoughts, forced away the cobwebs.

There—the humming separated into its own distinctive elements. He listened to a slow, easy wheezing. It merged with a steady but barely perceptible clicking. The sounds resembled those he might have heard aboard a ship at sea, yet they were also different, unlike any others.

And there was no motion. Could that be—? Not a shudder or a breath of motion. But every vessel has at least that much, every ship offers its signature in movement. So it couldn't be a ship.

He could hear more sounds now: a quiet hiss of air, like a breeze playing ever so gently across his face. It eluded him; it was so close, yet he couldn't place it.

He forced his eyes open. No, not really. There was another sound gnawing, rubbing gently at him. He fought to place it. He couldn't. Then he stared straight ahead at a glow. It was enough. The glow, and the gently rubbing sound. A human sound. A man's sound. Snoring, just barely. In that instant, with stark and absolute clarity, he *knew* where he was. He knew where *they* were, he knew everything that had preceded this moment.

He saw dim, glowing circles floating before him in the blackness—circles of red, flecked with touches of pale green. The glowing circles were dials. They contained letters and numbers and the tips of pointing needles that also glowed softly in the darkness. He had only to glance at the soft glow to know what they represented, what they meant.

The sounds—he had listened to the humming noise of the inverters, the subdued murmur of the blowers, passing oxygen through tubes and circuits and ducts. The snoring. That was Buzz. Christ, at least he was quiet now. After the needle they rammed into his arm. Fighting a madman. It happened so fast. He broke just like—*snap!* He thought of how Buzz had come apart. Snap. Like a twig breaking in your fingers. Walter Buzz Lloyd. Apollo Guidance and Navigation Systems pilot. His mind—he was the first to go. Couldn't take it. He couldn't take it.

Do you remember who you are? he asked himself. Sure, he responded with a cheeriness that made him sick. Pruett. That's me. Lt. Col. James R. Pruett, Air Force. Hero. Stuck in a tin can with two other very decent guys who were going to buy the farm with him. Buzz Lloyd, sleeping like a baby now with his mind drugged and damped down. At least he was quiet.

Pruett didn't need to look to his side to see how Stoney was doing. Clayton Stone didn't know the meaning of the word break. Not when it applied to himself. He slept like a baby. Christ, Pruett thought. So did I. Plenty of reasons for that. Weightlessness, exhaustion, a mental funk. And the lowered oxygen. Mustn't forget that. He thought again of the sounds that had nudged him when he came awake. He thought of the hiss of air and he smiled to himself in the near-blackness, amused that he had failed to recognize the sound of his own breathing.

The flicker of mirth vanished as reality crowded into his mind. He understood now why he had struggled to reclaim the enveloping comfort of sleep, the sweet limbo of not thinking. Now that he was awake, and alert, his mind functioning with precision, he could remember everything. He preferred to forget . . .

Abruptly he reached out with his right hand to grasp the edge of a long fabric strip. His fingers closed around a tab, and his hand jerked suddenly toward his body. He listened to a sound like tearing linen as the strip of Velcro came loose. Then he closed his hand around a curtain edge and slid the curtain along guiding metal rods. In this motion he unveiled a flat window.

He leaned forward to bring his face closer to the glass, and looked out upon the naked universe.

Billions of suns blazed before his eyes. For eight hours his eyes had been closed. They had adapted to almost absolute darkness. Now, nearly two hundred miles above the surface of the planet below, far above the mantle of thick and muddy atmosphere, he gazed in awe upon the unblinking heavens. The universe seethed with light. He knew he looked upon more than lights in the sky. His gaze swept great wheeling galaxies and glowing nebulae and the uncountable billions upon billions of suns.

His practiced eyes separated the glints of red, the soft touch of yellow, the gleam of blue and white, and the blazing heart of colorless stellar fires. At the lower left of the spacecraft window there shone one sphere of exceptional brightness. But this was a world, not a star, and it reflected the light of the sun closest to the planet below. The bright sphere was Jupiter, the planetary giant of his own solar system. It seemed so unbelievably close . . .

Ironman One was in rotisserie mode, turning so slowly he

couldn't feel the motion. The huge Apollo spacecraft showed its drifting movement in the barely perceptible drift of the starfield before his eyes.

He relaxed his muscles but his body made no response. He did not fall back against the surface of his couch, as he would have done at any time in his life until just six months ago. He knew now, as he dragged himself slowly awake, why he had wondered at the softness and comfort of his "bed." What could be more gentle, more comforting, than a cushion of air itself?

Not an ounce of pressure pushed against any part of his body. Not an ounce of weight pressed against his skin, tested his sinews, alerted his muscles. He felt a comfort so luxurious as to be impossible on the surface of the world below, a relaxation of body so unreal as to be beyond description. Weightlessness . . . falling around his native world with a speed so great as to be meaningless.

He floated inches off his contour couch, content for the moment to remain in the darkness of the spacecraft, bathed in the stellar glow of the universe. He floated without weight, without bodily sensation, lighter than the lightest of feathers, and plunged around the world at nearly five miles every second.

He stared vacantly upon the heavens, his eyes seeing the nuclear fires of space, while his mind drifted. He looked down upon himself; he observed his body and the rounded pyramid into which his body—and those of Stoney and Buzz—was woven, while the three of them, merged as one in a man-machine system, whipped through hard vacuum with a speed of nearly three hundred miles a minute.

He smiled without humor as he thought of plunging across the entire width of the United States in eight minutes. The figures meant nothing. Their speed meant nothing for there was no sensation of movement, no rush of flight. No, that was wrong. If he chose not to look through that window, if he excluded deliberately from his mind where he was, what he was doing, he then existed in a universe entirely apart from the world of men just below him.

His speed meant nothing, for he could not feel its effects. He had not felt it, the two men with him had no sensation of it for many months past. And yet their speed meant everything, for it had passed sentence upon them. The instant he thought consciously of this fact, his mind tried to shut it out, to throw up a wall that would keep out the dreadful reality.

But there could be no stopping these thoughts. A sentence of death had been passed upon the three of them. How could he ignore that? When realization first came to him—and it had to come to each of them in its own dreadful, terrible way—when there could be no doubt of his, *their*, predicament, he brushed away the tendrils of fear that snaked swiftly into his mind. He brushed away the fear because it did not take long for them to learn there was absolutely nothing they could do to save their lives. None could help the others, none could help himself. They had tried everything, and it didn't work. Ergo: there was nothing left to fear. His razor-honed senses and reactions, which had more than once saved his life, could avail him no longer.

Now he knew a great sadness, moments of bitterness. He thought of Celia, of their children, and he fought off the urge to bury himself in the sharp memories of his family. He thought of and knew many things but he was grateful that he did not know fear. He had courage; he'd learned that long ago, when he learned that every man who flew as he did always flew with fear. Courage was what enabled him to dampen the fear, to use it to sharpen his senses, to give him animal alertness. No one in test flying, or in combat, left the ground without fear as his companion. Call it whatever name you wished, those who had felt it always recognized it. One of the Gemini astronauts, asked if he was afraid during his mission, replied in the double negative. "Afraid? Hell, no, I wasn't afraid. I was scared." After a while, when you came so well to know fear, you accepted it, and you tried to be shrewd and turn that fear to your advantage. When disaster loomed, adrenalin squirted into a man's system. Fear opened the valves, fear quickened the reactions, let a man's training and instinct operate his limbs faster than his mind could command their actions.

And now none of it was worth a damn. None of his skill nor his fear. None of it within Stoney or Buzz. Since there was nothing he could do to change the facts, he—accepted them. He wasn't a hero. He was a realist. He'd never gotten around to asking the two men with him how they wrestled within themselves. He didn't think he would get around to it.

Because in two more days, give or take a few hours, he, and they, *would* be heroes. In two more days they would be martyrs, the first men to be claimed by space, the first astronauts not to return alive to the earth which had spawned them. Sure, Komarov was killed when his Soyuz tangled in his par-

achute shroud lines, but he'd come back through re-entry and he was thick in atmosphere when things fell apart on him, and death claimed the Russian only when his derelict spaceship pounded against the unyielding earth. No; the honors for the first men to die in space appeared to be all theirs.

There'd be speeches, he knew. He couldn't repress the grin that came with the thought. Officials of the National Aeronautics and Space Administration would make speeches by the dozens. Senators and congressmen would make speeches. Interminable words unwinding by the yard. The ladies in the hundreds of clubs around the country would sniffle into their handkerchiefs, the editors would eulogize, their friends would curse angrily—but at least they wouldn't have to suffer the speeches that would come in just about two more days.

Sentence had been passed by—*what?* A wire? A relay? A solenoid, somewhere? Beads of moisture in an electrical terminal? Unknown heat that caused wires or metal parts to flow just enough out of shape so as to be useless? An impossible chain of minute and unimportant failures? Minute and unimportant in themselves, but lethal in combination? He didn't know what had failed, but he, and the two men still sleeping beside him, would dearly like to know.

Behind them, only inches from their backs, separated by thick insulated walls and other shields, there stretched the thick, rounded form of the service module, and its stubby, flaring engine. Twenty thousand five hundred pounds thrust. A bellowing monster. Blazing fire and rocket push on command. The most reliable engine ever made by man. It had carried men around the moon, started and stopped with exquisite control, it had been tweaked in power bursts of less than a second, and it had bellowed and howled for long minutes to play orbital tag with the gravity of the moon and that of earth. It had never, never failed. Every part of the engine system was of the utmost simplicity in design. Moving parts were at their absolute minimum. Redundancy was the religious cry of its manufacture. Every part save that of the flaring engine bell itself was in duplicate.

It had never suffered even the *nth* degree of failure. Neither in ground tests nor in earth orbit nor on the way to the moon nor in orbit around the moon nor on the way home to the Good Earth. Even if the engine suffered a partial failure, even if it didn't scream with its full energy, it didn't matter. They didn't need ten tons of fiery push to get home. A fraction of that would work. Just enough to break that beautiful

balance between centrifugal force and gravity that pinned them like a fly into the sticky orbital path around the world below.

The designers of that propulsion system had left nothing to chance. Simplicity. Redundancy. Zero defects quality control. Tender loving care.

The system was foolproof. It had captured and tamed the moon for the United States. It was a delight for orbital operations around earth.

Their engine, the push for Ironman One, had only one weakness.

It had failed.

And so Lt. Col. James R. Pruett of the United States Air Force, detached from active duty and assigned as an astronaut to the Apollo Applications Program of NASA, was a dead man.

As was Commander Walter Lloyd, USN.

And Clayton Stone, civilian-scientist-astronaut.

Dead men. Or so they would be in two more days, give or take those few hours that no one could yet judge with truly reliable accuracy.

The commander—*ex*-commander, he reminded himself savagely—of the first American space station to orbit the earth, now trapped in the squeezed-together living space of the command module of Ironman One, looked through his capsule window as Apollo of metal rushed to meet the dawn. Hundreds of miles away, obscured by the huge curving mass of the planet, the sun began to make its presence known. At nearly eighteen thousand miles an hour Ironman One with its one observant and two sleeping men hurtled toward the exquisite beauty that was dawn as met by eyes in space.

Through the window of the spacecraft, as he arced well over the surface of the world below, it seemed to Pruett that it was not the capsule that moved, but the earth. He seemed to be suspended in space, hovering without movement in a star-studded bowl, while the massive sphere beneath rolled with ponderous swiftness toward him.

At the moment no moon was visible. Yet he could see clearly there were many cloud formations, although their features merged into the night. Toward the distant horizon the earth was absolutely black. This very abyss of darkness revealed the rounded edge of the planet, creating as it did a sweeping slice of stars that seemed to vanish impossibly at a lower point in the sky.

There came the first breath of light. It appeared as a whisper, the most gentle of touches to reveal the distant roll of the planetary surface. For the moment, Pruett forgot the death sentence under which they were flung through space. All his attention focused on the vivid, glowing crescent line that separated night from day. It was a crescent of rainbow hues, brilliant and gleaming. It glowed from within; it shone and radiated light and color, almost like a living band sliding along the spherical body of the planet. Ahead of the crescent line, even beyond the deep blood-red of its edges, light sped over the earth. In this twilight zone the surface lay in blackness, and the higher clouds were scalloped shells over which there was deposited a faint pink glow.

The speed of the dawn disturbed him. His tremendous velocity provided him a sunrise and sunset every ninety-two minutes. During his first orbits above the planet, Pruett and the others had marveled at this and were openly grateful they would have the opportunity to see the succession of dazzling displays. It was a matter of time being compressed, being squeezed, accelerated enormously. Every ninety-two minutes they whirled through a day and a night and plunged on to another day. They were in a time machine as the entire world spun rapidly before their eyes. After the first weeks in the S-IVB tank, their home in space for months to come, they failed to watch faithfully for the successive displays. But now . . .

How many more times will I be privileged to see this? he wondered. Even as he drifted in thought his eyes watched the earth turn. Beyond the crescent line he looked upon the velvet backdrop for the glowing dawn, the mantle of absolute black. The endless black of space lay beyond the iridescent dawn, with countless brilliant needlepoints of stars splashed against the velvet.

And then there were two worlds below, one blanketed in night, and the other washed in the light of the star about to lift above the horizon. It came with shocking suddenness, catching him by surprise. The sun burst from behind the edge of the globe and stiff-fingered his eyes with savage glare.

He winced with the pain and turned his head, cursing himself silently for his carelessness. He closed his eyes tightly, then opened them slowly. He was absolutely alert now; at least, he thought, the sun had jolted him back to some active thinking.

He reached out to touch the instrument panel with his fin-

gertips, and pushed gently. The slight nudge moved his body securely into the couch. Pruett grasped his seat strap and secured it across his midriff. He scanned the instruments, reached forward with his right hand and flicked a switch. The movement would bring Stoney from his sleep. But he'd awaken quietly. Neither man wanted to extricate Buzz from the protective cocoon he'd found in the drug-induced sleep. Who wants to bring a friend back into the midst of his private hell? Pruett glanced to his right. Buzz hadn't moved but Stoney was fully awake, watching him with eyes reflecting the brightness beyond their windows. Stoney gestured his good morning and Pruett smiled briefly. He twisted a dial and watched the brightness of the panel lights flood the instruments. For several moments he studied the satellite clock panel, noting the readings on the glowing dials, checking them off against numbers that glowed in small windows. He smiled to himself; none of this really meant a damn. Amazing what training and habit would do to a man with his head neatly in the jaws of death . . .

Again he glanced through the window, cautious this time to keep the sun from his direct gaze. He recognized the double stars of Grus. There was Fomalhaut shining off to the right of their flight path. There was Al Na'ir and then Peacock.

Australia below . . .

The Apollo command module was powered down to conserve energy, to reduce all life-giving elements to their barest level. Now he had to bring Apollo partially to life. He saw movement from the periphery of his vision. Stoney was checking his systems and assuring everything was exactly as it should be. Dead or not in a few days, you still did things by the numbers and, after all, you couldn't be given the ten count until your own systems quit moving. He brought up the radios—making sure the TV scanner was dead—to talk with the Muchea tracking station in Australia.

Throughout every moment of their flight a global network of tracking and communications stations pursued Ironman One. Thirty-foot antennas of unified S-band stations to handle voice and data transmissions spread across the globe at Goddard Center in Maryland, Cape Kennedy, Grand Bahama Island, Bermuda, Ascension, Antigua, the Canary Islands off Africa, Carnarvon in Australia, Guam, Guaymas and Texas. They tracked Ironman One and also sustained direct communications between the astronauts and the Mission

Control Center in Houston. They'd done the same for months while they lived aboard the capacious S-IVB tank serving them as a space station. Then, when they drifted away from the S-IVB within the command module, still attached to the service module with its maddeningly silent engine, other communications systems moved into the act. Where the ground stations slipped beyond the range of uninterrupted communications, airplanes and ships filled the gap. Eight JC-135's of the Airborne Range Instrument System and three long ships bristling with C-band and S-band antennas held strategic positions around the globe. Never for an instant was Ironman One beyond electronic reach.

Somehow all that miraculous gadgetry seemed terribly futile right now. While they slept, the Goddard computers had been working steadily on their unique problem—marooned in space. Engineers of North American Rockwell, of Aerojet-General and a dozen other companies, to say nothing of the NASA team, were tearing apart a spacecraft propulsion system identical to the service module of Ironman One. They were going through every tiny fraction of an inch of the systems, reviewing every line, every cable, every wire, trying to duplicate the condition that had blanked out and rendered mute their own engine system.

The Goddard computers, for example, had come up with more refined data on exactly how long they would remain in orbit. Not that it really mattered. They swung in a gentle loop about the planet, reaching an apogee or high point of just about two hundred miles. Their low point, unfortunately, refused to dip below one hundred twelve miles. The computers were chewing through the data bits sent to them from the tracking stations; the exact weight down to the last ounce of the Apollo spacecraft, and just how rapidly it would continue to change weight as its living passengers breathed, perspired, urinated, gave off heat, and performed other bodily functions. The computers digested the operation of the fuel cells and the batteries, the functioning of the life-support systems, the attitude of Ironman One, its exact height at any point in its looping sweep about the earth. They considered the rise and fall of the atmosphere by day and by night. They compared the spacecraft and its characteristics with hundreds of other bodies that had been in orbit and descended through orbital decay back into the atmosphere.

When they chewed it all they spat forth their answers. Answers? No—the *verdict*. They issued streams of thin paper

on which there would appear many numbers in code. When these went through the decoding machines men glanced at them and were able to tell exactly how long Ironman One would remain in orbit before orbital decay became meaningful.

Pruett, Stone and Lloyd raced through a hard vacuum. But vacuum hadn't for a long time meant what it had before the first satellites whipped around a world. Space was a radiation environment. It also swarmed, at this distance, with stray molecules from the onionskin atmosphere far below them. They orbited just above a border, an aerothermodynamic border, and its upper edges lay about a hundred miles above the planet's surface. If their spacecraft could dip well into that border it would encounter mounting resistance to its passage. Not much resistance. The finest machines on earth couldn't duplicate the hardness of that vacuum. But they were moving at nearly five miles a second, and at this velocity, impact with even sparse molecules has its effect.

The trouble was, their orbit was almost perfect. Their orbit lay just above the border at its perigee, or low point. Their orbit was decaying, all right, but the key to that decay was *time*. It was a race—and they were the losers.

If the orbital path decayed before their oxygen ran out, chances were that they would come to enjoy the notoriety of a narrow escape from death in space. If the oxygen ran out before the orbit decayed enough to bring them lower into the atmosphere—well, they had one of the most expensive coffins ever known to man. Pruett grimaced at the thought, then noted with some satisfaction that at least his sense of humor hadn't abandoned him.

While they slept, he knew no one would try to call them. No tracking station would disturb their sleep. Sleep was precious to them and it had nothing to do with being physically tired. Sleep meant time on their side. While they slept, their bodies slowed down physical processes. It required less heat to operate the human body in sleep. Sleep meant cutting down on the intake of bodily fuel. In physiological terms, fuel meant *oxygen*. The longer they could stretch out their limited oxygen supply, the longer they would remain alive.

They needed . . . not so much extra time, really. Pruett had run through some computations on his own. One to four days *after* the last of their oxygen was gone, he estimated, Ironman One would start its re-entry. But it didn't matter. Only one hour—only a few minutes "over" the end of the

oxygen supply would write *finis* to their flight, as far as they were concerned.

Their chances did not look good. In fact, mused Pruett, they were rotten. But one could never tell. The superfast IBM computers at Goddard, and the army of technicians laboring to solve their engine problem, might come up with *something*. Other than their swan song, that is.

Buzz had come awake. Likely he had been awake for some minutes without making any sudden moves. Coming out of a drugged sleep left you groggy for a while. And Buzz had been on the thin edge of breaking for some time. He couldn't shake the thought that he, Buzz Lloyd, was responsible for their predicament. In the last few weeks the strain of living aboard the S-IVB had gotten to him. Living in a canned environment and zero-g *all* the time demanded its toll. Buzz made a few mistakes and screwed up some experiments and on one occasion messed up the life-support system to the point where it endangered all their lives. From that moment on, the guilt complex crawled into his skull and mewed piteously at him. It got on *all* their nerves and finally, down on the ground, Charles Keith found himself worrying about their safety and ordered them down.

And now they were in it up to their necks.

Sometimes, when Buzz came out of his fog, he did so with the old snap he'd had when they first boosted out of earth and into orbit. Right now he seemed his old self. He released his straps, grinned self-consciously first at Pruett and then at Stoney, and eased himself forward. Here, bracing himself gently, he threw himself into a study of the complex controls and instruments of the Guidance and Navigation System. Buzz Lloyd was as much a part of GNS as it was possible to be while still encased in a human skin.

Right now he worked strictly from habit and to keep from chewing his fingernails or screaming without purpose. Habit, baby, habit. It kept the glue of oneself from coming apart in little pieces. Where the hell could they be guided to and to where would they navigate?

At least Stoney, on the far right of the command module, had something functional with which to work. The scientist-engineer-pilot monitored and controlled the onboard systems of the steel giant in which they ripped about the planet.

Pruett flicked the radios to life.

"Muchea CapCom, Ironman One here. How do you cats read? Over."

They must have been hanging onto the receivers in the station down below; the response was immediate.

"Ironman One, this is Muchea CapCom here. Good morning, you sleepyheads. Read you loud and clear. How me?"

"Rog, Muchea, you're coming in five by five."

Muchea asked for a status report and Stoney went through the checklist. They were all hanging grimly to routine and to habit; it was a thread of sanity for them all. Stoney cracked out the numbers on cabin temperature, pressure and humidity, primary and reserve battery power, fuel cells, temperature of instruments and various parts of the command module. Even the oxygen level went into the report without a quaver of Stoney's voice.

CapCom at Muchea was judicious, to say the least.

"Uh, Ironman, I seem to have missed the checklist on the service module. Say again, please . . ."

Missed, hell. Stoney had blocked *that* one from his own mind. The readings of the service module propulsion system were perfect. Absolutely right down the middle of the goddamn line. Perfect.

Except that the engine wouldn't fire.

At the moment they passed over Muchea, Pruett judged that under normal consumption rates, they had about forty-three hours of oxygen remaining. Could they stretch this out? No longer did he or the others think of oxygen in terms of pressure, but of hours. And, possibly, even of minutes. Could they lower their intake of oxygen still further, reduce the pressure in the cabin even more? The more time they could drain from the limited oxygen supply, the better the chances they gave themselves. The chances were bad to begin with, of course, but quitting was out of the question. Time, time, *time* —they orbited the earth, and life orbited about time, until the oxygen hissed empty, and the story ended. Neither Pruett, Stone nor Lloyd could tell—no one could—what the engineers would find as they went without sleep in their attempts to track down the malfunction in the big engine system.

Muchea CapCom came on again. "Ironman, you're fading out there. We're losing contact. Recommend you go over to Woomera."

"Okay." Be casual if nothing else.

"Woomera from Ironman. How goes it there?"

"Ironman, Woomera here. Loud and clear, Jim. How you copy?"

"Like church bells, Woomera. We're still pretty much in

chimp mode, powered down and drifting. You got our last report to Muchea?"

"Right. Got it all. Houston Flight has a report for you through Goddard conference.* You ready to copy?"

"Yeah. Fire away."

"Message from Flight is as follows . . ."

They all listened in stony silence.

They had forty-three hours of oxygen remaining. It wouldn't matter even if they could stretch it to forty-five or even fifty hours.

What did matter was that they wouldn't have enough oxygen to last them through. Hours before the spacecraft began to edge back into the atmosphere, they would be dead.

The computers at Goddard made it all very cut and dried. If they did *everything* to cut down consumption, they might get another six hours' oxygen at the very outside.

A shudder passed through Pruett, a body spasm that seemed to communicate itself to the other men. They looked at one another in the long silence.

So close; *so close!*

The computers had digested the raw data and spat out their answer. It was very neat and specific . . .

They would be dead for barely more than a day—twenty-eight hours—when the coffin known as Ironman One started its fiery plunge back to earth.

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* Apollo world-wide communications network.

Chapter II

"Ironman One, Ironman One, this is Canton CapCom. Do you read? Over."

Silence.

The communications operator in the tracking station on Canton Island in the Pacific, a speck of land in the midst of a vast liquid nowhere, tried again.

"Ironman One, Ironman One, this is Canton CapCom. This is Canton CapCom. Do you read? One two three four five five four three two one. Do you read, Ironman One? This is Canton CapCom. Come in, please."

The silence hung heavily in the room. The communications operator turned to a closed-circuit microphone.

"Radar, this is CapCom. We're not getting any response from Ironman. Do you have positive acquisition on tracking? Over."

A panel speaker rasped. "Radar here. That's affirmative. We've got positive contact. The spacecraft transponder is inoperative. Repeat, the spacecraft transponder is not operating. But we have positive contact, positive contact. Got it?"

"Roger, radar. Confirming you've got positive contact. CapCom out."

The operator turned again to the transmitter. "Ironman One, Ironman One, this is Canton CapCom. This is Canton CapCom. Do you r—?"

"Roger, Canton. This is Old Ironman and we read you loud and clear. Sorry for the delay. Over."

The operator let out his breath in a grateful sigh. "Okay, Ironman. You're coming in five by. That you, Jim?"

"Yeah. Everybody else is in the shower. What's new down there?"

"Got a message for you from Houston through Goddard conference. You ready to copy?"

"Shoot."

"Roger, Ironman. Houston will have specific data for you when you make your pass over them. Repeat, Houston will—"

Repetition just wasn't Pruett's cup of tea at the moment. "We got that," he broke in, a trace of irritation in his voice.

"Uh, right," Canton CapCom said quickly. The orders were out. Do not, repeat, do *not* irritate those people in that machine up there. "Uh, Houston has a, uh, a request for you. Over."

Pruett frowned. "Say again that last part. You were garbled."

"Roger, Jim. Houston's got a request they asked us to pass on. They advise a complete review by the Ironman crew of all procedures and steps taken since you separated from the S-IVB. Houston asks that you try to remember anything that may have happened since that time that might give them a lead on the SM malfunction. Repeat, they're anxious that you guys try to recall anything, no matter what, that might have been out of the ordinary. Did you copy? Over."

Pruett looked at Lloyd and Stone. The latter from his far right seat shrugged. Buzz Lloyd made a sour face. Pruett grinned at them.

"Yeah, we copied, Canton. Let's check that back with you. Houston wants us to try to remember anything during the flight that may have been out of the ordinary. Is that correct? Over."

"Affirmative, Ironman."

Stone gestured to Pruett and thumbed his transmitter. "Canton, Stone here."

"Hiya, Stoney."

"Say, Canton, we did remember something out of the ordinary that Houston might like to hear."

The CapCom stiffened. What could they— "Go ahead, Stoney."

"Roger. Pass this on right away if you would, CapCom. Tell Flight that the damned engine won't work. How's that for a starter?"

Lloyd broke into a chuckle and Pruett grinned again at Stone. Far below them the capsule communicator broke off his sudden laugh. For a moment he couldn't reply.

"Uh, Roger, Ironman. I sort of have the idea they're aware of that little problem. I—"

He stopped. He knew the three men in that damned derelict up there that was going to kill them. During the astronauts' training he'd spent hours with them at Houston. Several times he'd crawled into the command module mockups with them and they'd worked together on the radio equipment. He liked Pruett; he was a great pilot and one hell of a man. Buzz Lloyd was a gentle, warm bear of a man. Stoney was on the cooler side, but he was an egghead and you didn't mind it. The communicator shook his head. Those guys had less than forty-eight hours to live and—and they were trying to make with the funnies. CapCom dropped completely the official tone of his transmission.

"Jim?"

"Yeah."

"How about a personal favor for me from you guys?"

"Anything to oblige. Just send in your personal order by air express. What gives?"

"Just between us, of course. Will you people try to breathe *real* low and slow? Over."

A burst of laughter vibrated the speaker set into the radio console. "Okay, CapC—okay, Sam. Buzz says he'll try to program it into GNS. But it's strictly a personal favor from us to you, understand? Don't tell anyone, y'hear?"

"Ironman, you're starting to fade. Advise you pick up Hawaii. Over."

"Sure. No—hold on, Sam. Negative on the Hawaii pickup. Tell Houston we'll call them when we're in range. We want to do some skull time on their request. Got it?"

"Right, Jim. I'll pass it on. You'll call Flight when you're in range. See you guys next time around. Canton out."

Jim Pruett eased the pressure on his restraining strap. He paused in his motions as Lloyd's voice came flat and sharp in the confined space. "That's a lot of shit," Buzz said, anger in his voice. "What the hell do they expect us to do, anyway? We've been over this with them a dozen times since—"

"You never know," Stone broke in.

"You never know *what?*" snarled Lloyd. "You got any bright fucking ideas suddenly?"

"Can it," Pruett said.

"I just don't like—"

"*Can it.*" Lloyd glared at Pruett. The flight commander held his gaze, his eyes unflinching. "C'mon, Buzz. You know that sort of stuff isn't going to do any good." Pruett switched their train of thought. "Whose turn to make breakfast? I always think better on a full stomach."

"I'm not hungry," Lloyd growled.

"Well, *I* am," Stone broke in. "Stand by. I'll get into my gingham and whip up some pancakes, bacon, eggs and—anybody want steak?"

"Screw you," Lloyd said. "I've told you a thousand times I only drink a Bloody Mary for breakfast." He grinned at his friend.

Pruett offered silent thanks as Lloyd's basic good nature returned to him. The two astronauts started breakfast preparations and Pruett continued the movement he'd interrupted. His body floated gently upward from the couch. In his time in space he'd developed a sure instinct for completely unrestricted movement under weightlessness. There wasn't anything else in or out of the world as comfortable as moving around by your fingertips. There wasn't much room in the command module, especially after all the freedom they'd had in the S-IVB tank. But the spacecraft was an ingenious use of every cubic inch available. Stowing the center couch out of the way gave them three-dimensional movement and space with fingertip dexterity and that made a tremendous difference. On earth the command module was restrictive, confining and, literally, a pain in the ass. But not up here.

He thought back to his own choice of words with which he described the conditions in space and his reaction to them. None of the other astronauts, those who'd preceded him or the two men who were with him right now, had ever referred to the earth as "terrestrial." It was always earth, or the planet, the world, or the globe, or even the Good Earth, as Frank Borman had christened the home world on man's first flight around the moon in December, 1968. They were or had become the stock, commonplace phrases. But to Pruett, ever since his first moments, when he thought in a serious vein of space and his own personal participation in the grandest adventure and exploration known to the human race, he had adopted, without effort, the uncommon expressions.

They were, to him, pertinent and real. "Back on earth" and other such phrases had always seemed clumsy and awkward, and a tendency to cling to the familiar. Well, space

wasn't familiar—until you were in it for months on end, as they had been. But only the three of them. For everyone else, space had been a place to visit. Ironman's crew had lived there. And despite its familiarity after a time, it was still a screaming contradiction of normal life. It defied prediction; it teemed with hidden but meaningful surprises—even after weeks and months. You couldn't always foretell their nature. Most were delightful but some could be lethal.

The one lesson above all others that he'd hammered into his own skull was that you couldn't go into space with hidebound, preconceived notions and not expect to have them blow up in your face. From the very beginning of the program, no one group of men had been more off the beaten path of reality than the top scientists of the country. By now it was an old story, of course, but how many people remembered, not too many years back, when the scientists brushed off man as a helpless elongated blob of blood and flesh who could never withstand the violent forces of flight into, through, and back from space . . . The Black Box had reigned supreme for an uncomfortably long time, and pilots developed a hangdog expression as the Wizards of the shining ivory towers proclaimed the end of their usefulness. Electronics—ah, that was the answer. Electronics and solid-state gimmickry, and great electronic brains. They were better than man. Man was all used up when it came to space flight.

It was ridiculous from the beginning, of course. It had no more basis in reality than did a concept that rejected all machinery and electronic aids and proclaimed mind, muscle, and reflex as supreme.

The scientists had only to look directly in front of their noses to see the answer, but they didn't. They went at it the hard way. They ignored the man-machine system inherent in modern aircraft, in which the living creature and the machine merged into a single entity to attain the greatest performance, the greatest reliability—the *only* system with a built-in safety factor that could meet the unexpected and not fly to pieces like an alarm clock vomiting its parts in all directions.

Pruett bit his lip. He, Lloyd and Stone were snared by that unknown factor that could defy the best of the electronic sorcery and the best of man; one, in fact, that defied the best of both. Their spacecraft had performed flawlessly when they boosted atop a Saturn IB into high-earth orbit. It had been with them in space for months. Every time they'd checked its

systems it functioned as perfectly as they could ask. When finally they eased away from the S-IVB it continued its flawless operation. It performed in textbook fashion. It matched the marvelous operation of previous Apollo flights. Nothing went wrong. Nothing. The command module, Ironman One, was a beautiful, responsive bird.

Until *that* moment, of course . . .

They'd come up on the tail end of their final orbit before coming home, in perfect condition, flashing across the northeastern coast of New Guinea, rapidly approaching the point in space and time where they would fire the big engine of the service module. Their command and check sequence with the ground, with the ARIA aircraft, with the tracking ships, was perfect.

Ironman One came looping up to pass along the northwest edge of Australia, arrowing in its final orbit toward New Guinea. With practiced hands and minds the crew went through their final checklist with Muchea CapCom. Things could hardly have been better.

The satellite clock system was less than a half second off, but that was enough to bother Egghead Stone, and he corrected this at once. Stoney called off his checklist to Muchea CapCom in rifle-fire order. Buzz did a final recount on GNS, and guidance and navigation were right down the groove.

They did a last-moment purge of fuel cells, casting a spray of water and impurities away from the CM. Impelled by their sudden ejection from Apollo, they struck vacuum and instantly froze. They'd just come up on sunlight and with stunning effect the sun lanced into the frozen, twisting ice shards and particles. They gleamed and sparkled brilliantly, an iridescent shower of blazing fireflies accompanying them in orbit.

They were so busy watching a sight they'd seen many times before, but which still fascinated them, that Muchea called them with obvious irritation. "Hey, you guys playing gin up there or something?" There was a hesitation. "You're still up there, aren't you, Ironman?"

"There ain't nobody up here," Buzz growled into his mike. That's how things were. They'd been coming unglued in the space station for a long time, Buzz especially so, but now that they were on their way home a new sense of well-being had set in.

Pruett shifted his body position beneath the webbing of his contour couch. Much in the manner of a man preparing to

link his limbs and senses with the controls of a fighter airplane, so he prepared to become a part of Apollo. He placed his left hand on the RCS stick to operate the Reaction Control System. To kick Apollo forward he moved the stick forward. Pulling back pushed Ironman One backward. For side motions he simply moved the stick either to the left or to the right. Rocket thrusters fired to slide the giant spaceship sideways.

As the Apollo commander, Pruett needed to coordinate his maneuvering and attitude thrusters to make Apollo step lightly—and precisely. Pruett's right hand slipped around the pistol grip of the attitude control stick with which he could perform precision movements around the three axes of Apollo. To yaw the nose from side to side—pivoting the ship about an axis line that ran vertically through Apollo—he twisted the grip. He moved the stick forward and backward for pitch control to raise or lower the nose. Moving the stick to the left or to the right enabled Pruett to roll the spaceship much in the manner, although not with the same characteristics, that he would aileron-roll a jet fighter.

When everything was perfectly set, when the gyros and other instruments showed everything balanced, and all was coordinated with the magic element of time, the big engine would scream with more than ten tons of flaming thrust. Pruett and the others monitored the systems. They'd let the robot brain, the onboard computer, handle it all. But if there was the slightest deviation that wasn't corrected immediately, then Pruett would move and move *fast* to take over and fly the ship manually.

The checklist went like a piece of cake. They didn't even bother wearing their helmets. Ever since Wally Schirra said to hell with *that* in Apollo VII—afraid that the helmets would aggravate head colds to the point where it might burst their eardrums—the Apollo crews had for the most part disdained wearing this equipment. They had the utmost confidence in their equipment and that's all there was to it.

With everything right down the wire, Ironman One rushed out of Muchea CapCom range, and they established contact with CapCom on the *Radar Queen.* They rechecked for radio transceivers, that everything was remaining in the green. They whipped over the northeastern coast of New Guinea, ready for the big engine to roar explosively into life. The computer spat out its signals and Ironman One was locked tight into the exact attitude needed. Pruett called the

Radar Queen, staying fairly close to official communications signature.

"Pacific Command Ship, this is Ironman One. You read?"

"Ironman, this is Pacific Command Ship. Got you five by, Jim. How you? Over."

"Loud and clear. Sounds like you're on stereo."

"Roger, Ironman. Understand you cats have had enough roaring around the solar system for a while. You ready to come on down?"

Pruett laughed aloud and the others grinned. Derek Larsen never had been one to stay within official communications signatures. Once he had positive identification and contact, he threw the rulebook out the nearest window.

"Roger, Derek. We're all set here. We're even ahead of schedule."

"Okay, Ironman. We've got green lights for confirmation here. Your attitudes all look like they're on the button."

Buzz broke in. "What the hell did you expect?"

The word had been passed about Buzz being on the thin edge. "Roger, Ironman."

"Ironman to CapCom. We're coming up now to . . . to thirty seconds to go. We'll call the light. Over."

"Roger, Ironman. Standing by."

"The five-minute light is on. We should have the thirty-second light in just about—ah, five seconds—coming up . . . five, four, three, two, one and *light*. There she is, pretty and on the nose. The warning tone just went out."

"Very good. We've got TM confirmation. Timing is perfect, you guys. I'll count down to retrosequence and you'll call at five. Over."

"Okay, Derek."

"Here we go, then. We've got, ah . . . ten, nine, eight, seven, six, five—"

"Arm."

"—three, two, one, SEQUENCE."

"Okay! We've got it right in the groove, Derek. Green on the attitude. She's holding like we're locked in cement. How do your gauges read down there?"

"Perfect. Coming up soon to retrofire."

The Apollo spacecraft obeyed the electronically whispered command of its automatic brain. The computer balanced itself with its spinning gyros, scanned the horizon with infrared seekers, followed its orders to hold the spacecraft with the big engine chamber aligned along their path of flight, and roll

motions dampened out. For these seconds Pruett, Lloyd and Stone were content to be passengers. Watchful passengers, of course.

Some of the Mercury and Gemini flights had run through retrofire in beautiful fashion with the automatic systems delivering performance right on the nose. But even in Mercury, the last Mercury flight, in fact, with Gordon Cooper, the computer sort of strangled itself and Gordo went to manual, and he vindicated the astronauts and confounded the scientists by flying his Tin Can spacecraft manually through retrofire and down to re-entry with a precision even the computer couldn't equal. A few of the people in Gemini had the same problem and delivered in the same beautiful way. But now, especially with the brilliant record of Apollo, Pruett as commander was more than satisfied with the automatic equipment, and was content to ride along as manual backup to the computer for retrofire.

He kept his hands poised to take over manually in case things came unglued. His hands were relaxed, ready for instant movement, but not tense. He'd be ready to move if that was what had to be done. Even a delay in retrofire could be a pain. He didn't want them sailing out well beyond the recovery area and turning their planned recovery into a naval adventure. *That* they could do without . . .

"Ironman One, here we go. We're coming up on the five count to retrofire."

"Roger."

"Okay—coming up *now*: Five—four—three—two—one—*zero.*"

They braced for the sudden deceleration. After all these months in zero-g it would be one hell of a kick in the ass.

Nothing happened.

Without any conscious command, almost of its own volition, Lloyd's finger mashed the manual retrofire control.

Not a quiver from that big engine.

Instinctively, Pruett and Stone watching every moment, Lloyd stabbed down savagely.

Ironman One rushed through vacuum at nearly 300 miles a minute.

"Damn!" It burst explosively from Lloyd. For the moment Pruett and Stone kept silent.

"Ironman One! Do you have retrofire?"

"Negative," Pruett said. He was more pissed off than upset. So many damn months up here and *now* the equipment they

needed more than any other was crapping out on them. "Buzz has just about mashed the override control into the panel, but nothing happens. Over."

Derek Larssen's voice came to them stripped of all emotion. "CapCom to Ironman. Check your electrical systems readings at once. Over."

"No good, Derek." That from Stoney. "I've already scanned the board. We've got full power, everything in the green. We have no indicated malfunctions of any kind. We're still holding retrofire attitude. Everything's in the green. But we do not have retrofire. Repeat. No retrofire. No burn. No joy in Mudville. Over."

"Roger, Ironman. Stand by one—"

"We ain't going nowhere," Pruett added to Stone's commentary.

There wasn't much else they could do. Jim Pruett stared at the control panel and its gleaming instruments, the colored lights, the numbers and needles and the rest of it. Everything showed perfect. Nothing was awry. Not a single thing—fuses, lights, meters, dials, switches, controls, handles—they were all letter-perfect. He, and the others, knew the control panel and every device inside that command module with exacting, methodical thoroughness. Still, they scanned and studied every square inch of their controls and instruments. They did it a dozen times, on the chance that they still *might* have missed something.

When the retrofire failed, each man reacted differently. Outwardly there didn't seem to be much reaction. But in his own way each man felt his blood shift suddenly to ice water. The long mental preparation for the deceleration effects of the main engine, after more than five months of weightlessness, had primed their bodies and minds for *the* moment. The absence of deceleration came almost as a shock because of the anticlimax.

In that instant, Pruett knew they were in deep trouble. A man could overcome all sorts of problems with the spacecraft. They could fly and work and live with malfunctions up the gazoo. Lord knows other astronauts, American and Russian, had had more than their share. But if everything came unglued while you were in earth orbit—hell, you could set up for retroattitude and punch the retrofire button almost anywhere along the orbital route, and get down. Even if they splashed in the middle of nowhere, the rescue teams located throughout the world could get to them in a matter of hours.

Back in March, 1966, things went to hell with Neil Armstrong and Dave Scott in Gemini VIII. A short circuit in a spacecraft thruster turned Gemini and the Agena to which it was attached, in the first space rendezvous, into a screaming pinwheel. Armstrong played it fast and cool and with only seconds to spare kicked out of the pinwheel and straightened them out. Houston ordered them home because they'd dug into their fuel supplies reserved for re-entry maneuvers. Less than eleven hours after boosting from the Cape they were home.

You could handle just about anything in the way of an emergency. Anything—except a failure with retrofire.

Despite the enormity of the failure—and the immediate realization of its consequences—they weren't licked *yet*. There was always that chance of the engineers coming up with the answer. And there was . . .

Buzz Lloyd seemed almost to be reading his thoughts. "Any of you two geniuses give any thought to our going EVA and checking out this mother ourselves?" Lloyd exchanged glances with them both. "For all we know we got one mothering wire that's loose somewhere in all that plumbing. We haven't got that much oxygen to screw around here forever, and—"

"Give them a chance on the ground," Stoney said.

"*What* chance, for Christ's sake?" Buzz exploded. "All they want us to do is stick our finger up our ass and think about what we *maybe* did wrong. Goddamn them, we've been over the checklists time and back. All the TM was in the green. We—"

"Ironman, this is Houston Flight. Come in, please."

Saved by the bell, Pruett thought. *Ted came in just in the nick of time.* Ted Dougherty, his oldest friend in the business, was CapCom. Thank Christ for that, Pruett added to himself. There's nothing like having a guy on the other end of the line who *knows* what it's like "up there" when the shit hit the fan.

"Flight, Ironman here," Pruett said quickly.

"Hey, you old bum," Dougherty shot back, "how's the ride?"

"We lost our return tickets," Pruett said drily.

"Yeah, so I heard," Dougherty came back. He had no intention of playing hearts and flowers yet. Ted Dougherty and Jim Pruett had been through many a scrape together when their chances were a hell of a lot worse for surviving than

they were for Pruett and the two men with him. At least that's the way Dougherty saw it and that was the way he was playing it. What the hell, they weren't going to run smack into a mountain or something.

"Dick, I don't want to annoy you people too much—"

"Quit the clowning, Ted, will you?" That from Buzz Lloyd. Dougherty knew how tight they were playing it with Buzz. He was on the short end of the stick and the psychologists were warning everyone in sight to play his raw emotions carefully.

"That you, Buzz?"

"It ain't my sainted grandmother."

The laughter sounded both from the ground and space. Buzz seemed to be hitting his highs and lows in staccato fashion.

"Got some questions, Ironman."

"What's the prize?" Stoney threw in his two cents' worth.

"Maybe a trip down from the merry-go-round," Dougherty said. Without further preamble he slipped into business. "You get anything on backup on your last pass?"

"If we had," Pruett said nastily, "we'd be swimming in the ocean right now."

Dougherty ignored it. "Let me say that again. Did you get any instrument readings from the engine system?"

"Yeah," Stoney said. "A big fat nothing."

"No indications of any kind?"

At a glance from Pruett, Stoney stayed with it. "Negative, Flight. No, hold that. We were getting juice through the system. Full power, that thing. But no response. It's as if something were draining the electrical flow. No feedback, no kicks of any kind. The power goes to the engine but nothing happens."

"What was your check procedure on your pyro circuit breakers and, uh, also your Delta V thrust manual A and B switches?"

Pruett came into the conversation. "Ted, we had circuit breakers *closed,* SPS switch to *on,* Delta V thrust manual A and B switches *on.* Just like in the big book, Dad."

They heard Pruett all through mission control. Dougherty preferred to talk with the lead man in the command module. He knew Pruett better than the others. He could tell an entire situation just from the tone of his voice. So long as Jim Pruett was fielding the problem they wouldn't have any unexpected—human—problems. He had his doubts about Buzz

Lloyd, but Jim and Stoney would have to handle that one in their own way.

"Ironman, guess we'll have to see just how good you guys really are. We're confirming a new target and we suggest you set up for manual re-entry on your next pass."

"Roger, Flight. That's manual re-entry with the RCS backup system."

"Negative, Ironman. We—"

Three men in Ironman One stared at one another. Negative on the *backup* system when they were going to a manual re-entry because the automatic mode was all screwed up? Some things you can tell in an instant . . .

"—suggest using the primary system."

"We just told them," shouted Lloyd, "the goddamn thing doesn't work!"

"Flight, Pruett here. We'd prefer using the backup thrusters."

Dougherty took a deep breath and hoped they had Buzz strapped in.

"Negative, Ironman. I repeat, negative. I'm afraid you haven't got backup thrusters. You've—"

"What?"

"You've fallen too low on fuel. You'll have to stay with the primary system."

They studied each other carefully. Stone gestured with sudden anger. "Goddamn them," he swore. "Jim, what about the S-IVB? There's still oxygen in the lab. We can go back there and wait for them to send up a mechanic. For Christ's sake, there's six months of oxygen in the lab. We—"

Pruett motioned for silence. "Flight, there's enough oxygen in the lab to take care of us until next year. How's the fuel for our setting up a rendezvous and going back to the S-IVB?"

They felt a little colder with the next line. Of course, they couldn't see Charles Keith standing behind Ted Dougherty. Keith didn't want them returning to the lab. But it didn't matter as Keith shook his head at Dougherty. CapCom didn't need to tell tall stories. The facts were bad enough.

"Negative, Ironman. You're too low on fuel for a rendezvous with the S-IVB. You're going to have to try retrofire again with your primary engine."

No answer. Dougherty stepped in once more. "The smart boys think the automatic control system is out and your trouble's in there. The signal's getting blocked. They say you'll be

able to get ignition from SPS on manual command. In other words, we'd like you people to kick the box."

Buzz Lloyd laughed harshly as he looked at Pruett. "Jesus Christ, Jim, did you hear that crap? Kick the box?"

"Did you copy, Ironman?"

"Yeah, yeah, we got it," Stoney snapped. "We don't like it but we got it."

They went to work. Stoney was right. None of them liked it. Something was wrong with the way they were setting up the attempt to go manual. They didn't know what, but it was there. But at over seventeen thousand miles an hour you go around even a planet pretty damned fast, and they went to work.

Jim Pruett had a premonition. He didn't know why, whether it was a sixth sense or merely the accumulated frustrations leading up to this point. Plunging around the planet, he'd ordered his crew into pressure suits and helmets, and everyone buttoned up. Buzz grumbled aloud and Stoney met his orders with a glare, but these were healthy signs. Coming up for the new attempt at retrofire, Buzz, floating for a final few seconds before strapping in, sweated freely within the helmet. Stoney had already checked the temperature controls. He didn't change anything. The perspiration was more psychological than physiological. They were working now like a well-drilled team.

"Set pitch and yaw gimbals," Stoney called.

"Roger," Buzz came back, a bit too slowly.. "Pitch trim plus one point two five."

"One point two five," Pruett confirmed.

"Yaw trim minus point seven zero," Buzz said.

"Point seven zero," Pruett echoed.

"Zero attitude error needles," Stoney called.

"Error needles at zero-zero-zero." Pruett again.

"Trans control at neutral," Stoney called from the checklist.

Pruett: "Trans control neutral."

Stoney again: "Delta V switch on."

"Roger," Buzz confirmed. "Delta V switch is on."

Dougherty's voice mixed with theirs. "Two minute time hack on my mark."

"Okay," Stoney said.

"Right. Coming up," Dougherty came in. "Three—two—one and mark."

"Roger," Pruett said. "Time to ignition two minutes."

They didn't see Ted Dougherty on the CapCom console in Houston. So they couldn't see his fist pounding slowly and methodically against the arm of his chair. Nor could they hear his chant. "Fire, you bastard," he hissed. "Fire, fire, fire, *fire.*"

Dougherty felt eyes boring into the back of his head. He turned to stare at Charles Keith. The NASA director of the nation's manned space flight program looked at him carefully. He didn't try to hide his contempt for Dougherty's show of emotion.

Dougherty looked at Keith with unblinking eyes. Very quietly and very clearly he said, "Up yours," and turned back to the console.

"Thrust switches to normal," said Stoney.

"Right. Thrust switches normal," Pruett confirmed.

"Inject prevalves on."

Buz fielded this one. "Okay. Inject prevalves on."

"One minute." Pruett's warning.

"Arm translational controller." Stoney was all machine.

Pruett pulled the instrument over until the word ARMED showed clearly. "Armed," he snapped.

"Ullage," Stoney said.

Pruett's hand moved; the translational controller went in slightly. "Thirty seconds," Pruett said.

"Thrust-on enable," Stoney called.

Buzz Lloyd moved his gloved hand forward, unlocked the control, gave it a half turn. The button clicked twice. "Thrust-on enable," Buzz confirmed.

"Fifteen seconds."

They sweated out the longest seconds they had ever known. The spaceman's chant went to ten, then down the seconds until they held their breath and braced themselves for "*—two —one—retrofire!*"

Buzz ground his gloved finger against the button. They tensed anew for the roaring crush of deceleration.

Nothing.

Instantly Stoney barked out the command. "Direct Delta V switch!"

Pruett had already moved. His hand grasped the Delta V switch and jerked it out and up.

Nothing.

Buzz slammed his finger again and again into the thrust-on button.

Nothing.

"Ironman, Flight here."

Pruett's face was set in granite. Not even the sound of Dougherty's voice moved a muscle. *What the fuck can he say now!* cried an inner voice.

"Ironman, Flight. Do you read?"

"May as well talk to the man," Stoney said. He moved to the side to grasp Lloyd's hand. Buzz was still stabbing the button.

Pruett nodded. "Go, Houston."

Dougherty sighed. "Jim, do you affirm retrofire? We lost TM here and—"

"Negative, Flight."

It was so cool and quiet Dougherty didn't believe it. Not at first.

"Say again?"

"I said negative. We had negative retrofire. Negative, no, negative. Got it?"

Charles Keith grabbed the microphone. "Ironman, this is Keith here. Do you get any indication from your event lights?"

Pruett scanned the myriad of instruments and dials. Finally his gaze rested on a round button that glowed green. The button showed one word clearly. In bright green it read: RETROFIRE.

Pruett smiled coldly. "Yeah, Boss, we got a little light here that says we have retrofired. It's green. Very pretty. We're going to decorate it for Christmas."

Keith's face remained impassive. He'd been in the business when Jim Pruett and the others were playing with model airplanes.

"All right, Ironman," Keith said. "We're going right to work on it."

"Sure thing, Boss." Keith didn't hear the sarcasm in Buzz Lloyd's voice. He'd already removed his headset and was walking away from Dougherty's console. Dougherty turned again to the mike.

"We'll sweat it for you, Ironman," he said, knowing just how empty his words were. "Why don't you cats get out of your suits and take it easy for a while? This may take a few hours."

"Rog," Pruett said.

"Relax, Jim," Dougherty added quickly. "We'll see you soon."

"Sure. Soon," Buzz muttered.

Stoney hadn't said a word from the start.

Neither had three other people. One sat impassive, the other couldn't control light twitches of facial muscles, the third gnawed at her knuckle. They were three women. Three wives in a glassed-in booth, waiting for their husbands to start home from a celestial beartrap called orbit.

Celia Pruett, Betty Lloyd and Teresa Stone. They were alone in the VIP gallery.

"Jesus Christ," Dougherty swore under his breath. "We forgot all about them."

Keith stood nearby. "Get them out of here."

Dougherty turned. "And what the hell am I supposed to say to them?" he snarled.

"Tell them goodbye," Keith said coolly, walking away. "I'm too busy to play nursemaid and so are you."

Ted Dougherty didn't avoid the eyes staring frankly into his own. "There was no retrofire," Dougherty told the three wives. "They're still in orbit. You saw that." He laid it out clean and straight. "It's going to take a while to psyche out the engine."

He waited for the pause. Betty Lloyd sighed. "Well, I think it's time to go home and light the fires and mind the kids." She gathered her things. "Anybody need a ride?"

Celia Pruett kept her eyes on Ted Dougherty. She'd known him almost as long as she'd known her own husband. "You talked to them?" she asked.

"They're all right, Celia."

"I didn't ask you that."

Dougherty nodded. "I know. Sorry. I talked with them. And they're still all right."

"For how long?"

He didn't try to field that one. Trying to ignore it didn't work, either.

"For how long, Ted?" This time it was Teresa Stone.

"We'll keep in touch, Teresa."

"I don't want to be kept in *touch*," she said, almost but not quite snapping her words. "You know me better than that, Ted Dougherty. I've told the bad news to too many wives and you damn well know it." She spoke with a blunt-

ness Dougherty had never heard before. "Just don't crap me," she said softly. "I want to know what's happening."

Betty's hand went to her arm. "Teresa, Celia and I have been in this business for fifteen years. This may sound like a speech, but it isn't. We've learned that the best thing is for us girls to keep our feelings to ourselves and let the men get on with their jobs. Isn't that right, Celia?"

Celia looked up. "You're wrong." She paused as the others stared at her. "It's been more like twenty years." She walked past them and out of the building.

Chapter III

Jim Pruett unlocked his helmet and removed it carefully from his head. For a long moment he let the helmet float freely in the air before him. He kept his eyes closed, trying his best to keep hard control on his emotions. It wouldn't do anybody a damn bit of good to come unglued now. This is what he was paid to do. No one had ever pushed him into this goddamn module. It was time to really start earning his paycheck. They'd made him the boss of this operation because they knew he was good, and now he had to prove it.

He opened his eyes, watching Buzz drift to a window to stare out. Stoney was on the other side of the command module, silent for the moment, looking out at something. Or nothing. Just looking, maybe, Pruett thought. But even as he looked at them he felt sympathy for them. Their faces were gaunt and showed their exhaustion. Mental and emotional more than physical, perhaps, but you were just as whipped. Pruett glanced outside. The changing light within the spacecraft told him what he saw before he looked. They were rushing into nightside and the glow from the sun bathed the faces of the other men, casting upon their features a waning ghostly light.

They fell around the world, uncaring of the stunning beauty about them.

"Jim?"

Pruett glanced at Lloyd.

"Why are we just lying here, waiting?"

"You know the answer to that, Buzz. They're analyzing all the telemetry, and somewhere in that pile of paper is the answer to what we need to know."

"Bullshit."

Pruett raised his eyebrows.

"I mean it," Buzz said, his expression dead serious. "We're up here doing nothing so some smart-ass engineer can tell us we're out of luck. Stoney said it before, didn't he? I mean about the EVA. Let's get the hell out there ourselves and check out the engine. Maybe the damn fuel valves are frozen, and—"

"Ground could tell us that," Pruett said.

"Or maybe we took a rock somewhere in the system. It doesn't have to be a big one. It could have been a real small meteor, you know. Small but big enough to chew up something. We wouldn't even need to have known about it when it hit. Or maybe something got hung up when we separated from the lab." Pruett didn't respond. Let Buzz get it out of his system this way. Then Buzz demanded an answer, his voice petulant.

"Relax," Pruett said with a smile. "And eat your chicken while it's hot."

"Jesus Christ, you sound like my mother," Buzz complained. He grabbed a chunk of processed chicken and popped it into his mouth, chewing listlessly. He watched the third man in the ship.

"What you looking at, Stoney?"

Stone gestured in the direction of the planet below. "Big mess building down there," he said, surprisingly caught up with the sight of something beyond their immediate dilemma. "Disturbance in the intertropical convergence zone."

"Huh?"

"Somebody's going to have a hell of a hurricane on their hands," Stoney said. Gleaming in the early light, a great swirl of clouds, showing vertical separation even at their height, stretched for hundreds of miles across the string of islands leading away from Florida and Cuba toward South America. The spiral arms were fully developed, the eye dark and forbidding. It was the kind of storm that grew with explosive speed and fury, and this was growing in just that fashion.

"Nice thick clouds," Stoney went on. "Good east-west slope. Cyclonic circulation is just taking hold. Yeah," he

smiled, "she's going to be a big beast." He turned to the others. "Alma. That'll be her name. First of the season."

Buzz Lloyd stared at him in disbelief. "A goddamn weather report, so help me—"

Three engineers sat before a control panel. Two wore earphones and they worked methodically through a countdown. Beyond heavy leaded glass could be seen the dim outlines of a rocket engine and its flaring combustion chamber. The engine was marked Unit H-37, Block Four. It was an exact duplicate of the engine in the service module to which Ironman One was attached. An exact one-to-one duplicate. The conditions under which they were about to attempt to fire this engine were a duplicate of that in orbit. Obviously, with everything matched so precisely, the engine would not fire. In this manner the engineers could determine what had gone wrong with the Ironman One SPS system, and they would be able to effect the cure that would bring home three astronauts marooned in space. The count went down to three, two, one and an engineer called out "Retrofire." His face took on a stunned look as the test engine crashed into flaming thrust and illuminated the entire chamber. The sound slammed at them. "It—it can't be," one man cried in anger. "That son of a bitch can't fire, it can't!" The terrible roar of more than twenty thousand pounds thrust drowned out his words.

There were twenty men in the room, seated around the long conference table. Among them was Charles Keith, Chief of Manned Space Flight for the United States. There was Paul DeGrote, the Mission Director for Ironman One. Richard Wheeler, the Flight Director. Ted Dougherty, Chief Astronaut of the manned space program. General Charles Parker of the Air Force, representing the Department of Defense, and with him his aide, Major Paul Eastlake. There was Colonel Ike Saddler, tough and experienced boss of the Air Force's booster program; Dougherty had personally called Saddler to the conference. Adrian Fisher and Jimmy Klein were two of NASA's best trouble-shooting engineers.

They had just listened to the shocked voice of the engine programmers, whose test engine, rigged so that it would not fire, had fired perfectly.

Charles Keith's expression did not change. He glanced at the red telephone on the table before him, then scanned the group with unblinking eyes. "The President is waiting for our

recommendations," Keith said. He glanced at his notes. He might have been at a meeting discussing a weekly sales report. "One," Keith went on, "a statement will be issued at the conclusion of this meeting. Every effort is being made by the entire NASA to discover and to correct the spacecraft malfunction, in accordance with the contingency plans we have always maintained to meet such emergencies. Two. A report is to be issued this Tuesday morning by the Director of Manned Space Flight. That report will emphasize strongly the high degree of safety and the astounding success reached in our manned space program to this date. The, ah, accident involving Ironman One is not to be played up. We will simply compare it with the failure of an experimental aircraft. In this business, the report will stress, in the development of experimental aircraft a ten per cent pilot loss is considered acceptable, and is, in fact, a matter of record."

Ted Dougherty twisted a pencil in his fingers. He looked down at the table so as not to reveal his emotions. He listened to Charles Keith and he thought of Jim Pruett. He thought of Buzz Lloyd and of Stoney Stone and he clenched his fingers until his knuckles went white.

"Wednesday morning," continued Keith, "if it is necessary to do so, the President will issue an appropriate message to the nation, emphasizing the courage and the determination of the crew of Ironman One. We will stress their final wish that the program continue without pause." Keith looked around the table. "Is there any discussion?"

Paul DeGrote looked up, his mouth twisted. "Discussion? What the hell kind of discussion do you want? We're about to be crucified, dammit! Don't you understand that?"

Dick Wheeler grasped his shoulder. "Easy, Paul," he said softly. "Take it easy."

"Get your hands off me," DeGrote snapped. His eyes were huge. "We're about to see fifteen years of work go down the drain just because that goddamned Lloyd got tired! They're going to chop us off at the knees. One man gets tired and can't do things right and we're all going to—to—"

He stared in horror at the faces locked onto his own. "God, I'm sorry." He slumped in his chair. No one looked at him. They didn't have time to waste. Some of the men at that table still hoped for the miracle.

"Anything else?"

Ted Dougherty leaned his weight on his elbows and gestured with the pencil. "Yeah, I got something." Heads

turned. "I want to talk about a rescue mission," Dougherty went on. "I'm speaking for all the pilots and some of the Air Force people. We propose launching a rescue craft using one of their boosters. A Titan Three-C. We can rendezvous with Ironman, transfer the crew and come back here in—"

"You haven't been listening, Dougherty." Keith turned to the Mission Doctor. "Dr. Kortney, would you *repeat* the trend data on oxygen consumption in the spacecraft."

Papers rustled and Kortney cleared his throat. "As of right now," Kortney rumbled, "they're going to live another forty-two hours, plus or minus maybe five per cent. That takes us up to ten-thirty Monday night."

Dougherty couldn't be put off that easily. "There's a launch window for a shot at eight forty-eight Monday night."

Keith stared at him. "There's nothing to put in that window."

Dougherty glanced at Ike Saddler and back to Keith. "The hell there isn't. A Titan Three-C core left Denver for the Cape an hour ago."

Keith didn't respond. Dougherty nodded to Saddler and the colonel spoke quickly. "Mr. Keith, the truth is that bird was already in the pipeline on the way to the Cape. We had, uh, one of our X-RV vehicles, a lifting body, at Edwards, and that's been started on its way to the Cape also."

Dougherty didn't give Keith a chance to step in. He pointed the pencil at Saddler. "Colonel, could you get that Titan and the X-RV on the pad and ready to go in forty-two hours?"

Saddler came right back to him without hesitation. "Some of our boys think they could."

"They *think* they could?" Keith wasn't to be shunted aside any longer. "We're not dealing in thinking about possibilities, Colonel. With all due respect to you and your men, that's not acceptable. There's either a yes or a no." He gestured impatiently to cut short a protest from the Air Force officer. "You're talking about a booster that isn't man-rated, remember? You're also talking about a lifting body spacecraft that has never flown in space. And then you're talking in terms of thinking instead of knowing."

"That lifting body will fly, all right," Saddler protested. "And Dougherty here has—"

Keith's expression was open scorn. "The proposal is rejected. Anything else?"

Dougherty bristled. "What the hell do I tell the pilots?"

Charles Keith showed open, genuine surprise. "Tell them?" He stared at Dougherty. "Tell them their request is outside the area of their competence."

Dougherty didn't believe it. The faces flashed before his eyes and before he knew what was happening he was on his feet, fists balled, shouting, "You got three men dying up there!"

Keith didn't bat an eyelash. "I didn't think I'd have to remind *you* of something. Those men are professionals. If they were sitting here in this room, they would say take what you've learned from this mission and get going on the next. They—"

"I don't give a damn about the *next* mission."

Keith pushed away the papers before him and studied Dougherty's face. He took a deep breath and spoke carefully. "Dougherty, you either calm down or I'm going to throw you out of this program."

"All right, damn you. Fire me."

The room remained silent. Keith nodded slowly. "All right, then, it's time for school, I suppose. You want to launch a rescue mission in forty-two hours, right?" He didn't wait for any confirming remarks. "Let's take a closer look at your scheme. One, you must assemble and check out the booster first stage, the second stage, and the transstage. You've got three different systems. You've got the five-segmented solids, you've got the first and second stages of the core, and then you've got that transstage." Keith snapped his eyes to Saddler. "Colonel, how long does this take on the basis of past *performance?*"

"Well, uh, on past performance, twelve days, but—"

"You're talking about the liquid-propellant vehicles, aren't you, for that twelve days?"

"Yes, of course, but—"

"You weren't including the solid stacks in there. Now, how long to build up, strap on and check out the solid segments of the booster?"

"Four days. Perhaps not the—"

Keith ignored him and Saddler fell silent. Keith was back to Ted Dougherty. "We'll take point three. Dougherty, have you checked the launch conditions? The weather? There's a hurricane—"

"Six hundred miles off the coast and headed out to sea," Dougherty snapped.

"You're in luck, aren't you?" Keith said coldly. "We still

haven't talked about the spacecraft, have we? We haven't said a word about the time to mate the X-RV to the booster and check out the configuration. Colonel, would you like to field that one?"

Ike Saddler turned to Major Eastlake. " Paul?"

The major shifted uncomfortably in his chair. "Sir, we haven't any way to determine *accurately* the minimum time. It's possible—"

"You couldn't do it under five days." Keith made it a flat statement that dared contradiction. When none came he went on. "Fourth point," he hammered to the group, holding up four fingers. "You've got to compute guidance and navigation tapes for first apogee rendezvous. *That* little gem requires *ten* days. To program your computers requires three *weeks.*"

Dougherty set his fists on the table before him. He wouldn't back an inch. "We'll go without the computer," he said between clenched teeth. "We'll go without a checkout."

Charles Keith ignored him. "Fifth point. There's the little requirement for crew training. And I mean *training*, not orientation or familiarization, with the spacecraft systems. That training must include complete capability for rendezvous on the first apogee. It's got to be done in a craft which is *not* man-rated for space flight. The X-RV cannot be flown by one pilot. It's designed for two. And it holds only two pilots, not four, which it must do in order to bring back four men from orbit. How much time for all that, Dougherty?"

"We'll do it in forty-two hours."

"Uh-huh." Again that deliberate pause that held them all on the edge of their seats. "And while you're assembling your prize package of a rescue ship, which doesn't yet exist, in these forty-two hours and spending—" Keith turned to Adrian Fisher, the NASA engineer. "What will it cost, Fisher?"

"Fifty million."

"Fifty million *dollars,* Fisher?"

"Yes, sir."

Dougherty let out what sounded like an animal growl. "So what?"

Keith brushed aside the comment, this time spearing Jimmy Klein, the other NASA engineer. "Plus how many deaths, Jimmy?"

Klein answered with alacrity. "In a program of this magnitude, in which all nominal safety factors are disregarded, I calculate point oh-two per cent of the work force will be fatal casualties."

Dougherty's voice was a shout over that of Klein. *"How the hell do you know? How the—goddammit, how do you know who's going to die?"*

Charles Keith slammed a large black book onto the table and stabbed it with a finger. "You think we haven't considered rescue? You think you're the only one who tries to consider everything? Here, blast you," he said sharply. "Rescue and every other contingency, all of it reduced to digitals and computerized. All here. From every angle. Front, back, sideways, from the top and through the bottom, coming and going. All of it. It's right here between these pages. You know what it says. *You* helped to write this damn thing. Remember? A rational approach. *The* approach."

Keith grasped the book and flung it angrily across the table.

With a contemptuous sweep of his hand, Dougherty hurled it to the floor.

"Screw your rational approach," he snarled. "Three of your pilots are in trouble. They're going to die unless you, we, do something about it. And if you don't try to get them down, then *God damn you.*"

Keith's burst of temper had vanished as quickly as it appeared. "You have feelings," he said, quietly and with complete assurance that the words he used were the only ones to be applied to the situation. "Good. I have feelings, too. That's why we live by rules." He turned to take in the others with a single glance. "Fisher, Wheeler, Klein—you all have feelings. These pilots are your friends. *Can you launch a rescue mission in forty-two hours?"*

Silence.

No one answered. Two pairs of eyes swept the others at the table. Dougherty's, and Keith's. Still no one answered.

The phone rang. Keith grabbed it. "Yes, sir." Pause. "We're ready on this end." Again a pause, longer this time. "Right. Yes, sir." He hung up, looked at the others in the room. There was an air of finality to his movement.

"The President will take the call at seven o'clock his time. That's in one hour and fifteen minutes."

He rose to his feet and left the room without a look behind him.

"The bastard."

If Keith heard Dougherty's final remark he paid it no attention.

Suppose, Pruett conjectured, the engineers tear down a duplicate propulsion system and they *do* find the snag that had them hung up in orbit. That didn't mean they could repair the failure where they were. It didn't mean, not by a hell of a long shot, that he or Buzz or Stoney could do a thing about it. They might learn in painstaking detail exactly what had gone wrong, and the knowledge would be damn little comfort to them when the last of their oxygen finally hissed out of the tanks.

That last message from Ted Dougherty hadn't done any of them a bit of good. Why don't you strip down to your underwear and relax, huh? Ted should have known better. It meant only one thing. The engineers had already made their first attempts to trouble-shoot the problem and they'd come up with zilch. That meant they were going to cut the guts of the propulsion system. Take it way back to the beginning and inch their way through anything and everything. On that basis, pondered Pruett, they might achieve success about three weeks after they were all dead up here.

The others were quiet, lost in their own thoughts. Buzz was half asleep, murmuring in his dream world between full sleep and wakefulness, succumbing to the aftereffects of the drugs, the seeming hopelessness of their situation. Stoney was deep in thought. He was often that way, eyes lidded, facial expression frozen, but his mind churning steadily. Pruett appreciated the sense of quiet he was given for the moment.

He stared at the oxygen indicators and at the sweep hand of his clocks. He could almost hear the ticking. Each little arc of movement meant that much more oxygen gone. Each time the second hand swept around it meant another minute of life gone, gone forever, never to be reclaimed. . . .

He saw things with a terrible sense of motion slowness, saw them in his mind. He saw the perfect harmony of their spacecraft as it swept around the planet, the wonderful harmony of balance between centrifugal force and gravity.

Everything in space occurred with a mathematical precision and order. Everything in space obeyed the commands of celestial mechanics, and sometimes it was so damnable a paradox. To return to earth, they must fall. To spill back into the waiting atmosphere, they must fall.

But that was exactly what was happening to Ironman One. They were weightless because they *were* falling. They were plunging in an infinite fall around the earth.

The commands of celestial mechanics were of the finest

order and harmony. They were beautiful; they had always fascinated him. And, Pruett knew with increasing realization, they were also a beautiful, harmonious trap.

The spacecraft whipped through vacuum, falling in the most shallow of arcs. You can't repeal the law of gravity. But you can bend it, so to speak, and this is what they did with Ironman. Its velocity gave it a great, outward, whip-cracking effect. Instead of falling steeply, it fell in that smooth, deceptively shallow arc.

But it did not approach the earth, and that was the wonder of it. For the shallow arc of the fall was a splendid mating to the shallow curvature of the planet itself.

As fast as the spacecraft fell, the surface of the earth curved away beneath its curving line of flight. So they fell within the Apollo spacecraft, and they would keep on falling until something could rearrange that harmony, that balance. They needed to steepen the curve, to bend it a little tighter toward the earth.

That was where that goddamn big engine came in. The engine in the service module that had *never*, until the mission of Ironman One, failed its passengers. When they fired the engine—or were *supposed* to fire the mother, Pruett thought wryly—they would decelerate. Slow down by a few whiskers from their great speed. Their plunge through space would drop them to maybe 17,200 miles per hour. More than enough . . .

Gravity would assert its sudden superiority to centrifugal force. The cracking whip of their velocity would be just a shade reduced. They would fall along a slightly steeper curve. And very soon they would embrace the edges of the terrestrial border, the upper, extremely tenuous remnants of the ocean of air far below.

What's tenuous at a comfortable, slow speed can be a mass of sticky glue at three hundred miles a minute. The sparse molecules of air were a vacuum in terms of man and survival, but that's strictly from a relative viewpoint. The racing spacecraft would start to slap against the molecules. It would hit hundreds of them, and that wouldn't mean much. But the numbers would rush upward on an almost vertical scale, to the thousands, the millions, the trillions, and uncountable numbers beyond.

Everything was so beautifully in balance. It takes kinetic energy—*heat*—to get a capsule in orbit. That energy came from the howling fires of the big Saturn IB booster. The Sat-

urn exchanged heat, its kinetic energy in the form of thrust, for velocity. Orbiting the earth, their spacecraft was a supercharged package of kinetic energy.

It didn't seem that way, but it would—it surely would—in re-entry. They would have to get rid of just as much energy as it had taken to get them into space—in order to get down again. The laws were inexorable. They must exchange heat for heat, energy value on an equal basis with the big push into flight through the seas that lie beyond the world of men.

They would yield that energy in the form of friction. The atmosphere would quickly become a seething furnace of heat. They would plunge earthward with a bow wave—a shock wave, actually—riding well ahead of their blunt heat shield. A bow wave of more than 11,000 degrees temperature, hotter than the surface of the sun. Barely a foot from their backs the ablative heat shield, the outer structure of stainless steel honeycomb bonded between steel alloy sheets, the surface applied with phenolic epoxy resin ablative material, would take the punishing lash of friction. It would soak up heat, would blaze at 3,000 degrees, and would spatter away the terrible temperatures in wisps of gases and flowing resin.

They would . . .

"*Can that crap!*" he commanded himself, in harsh tones. The explosive outburst at himself took Pruett by surprise. His years of experience, his training, his fine edge of subconscious protection against a dangerous situation, came to his aid. He realized with distaste that he had allowed his mind to slide without control into a wishful state. He was startled at the clarity with which he imagined the re-entry through the atmosphere. But what the hell! He'd done it twice before and there had been plenty of flights back from the moon at 25,000 miles per hour—a hell of a lot faster than they were going. Pruett at that moment was grateful that he was himself his harshest critic.

Years of flying, much of it in experimental airplanes where mistakes and sloppiness brought only disaster, had created in him an unbending drive toward perfection. And tricky airplanes killed a hell of a lot more pilots than did spacecraft. Perfection was of course unattainable. This did not in the least interfere with Pruett's drive for the impossible, for it promised, if nothing else, the highest possible level of skill and capability. Answerable only to himself, he regarded excuses as a weakness and alibis as worthy only of disgust.

He tried to concentrate on Dougherty's request. Try to re-

member—anything. He realized that it was possible for him, for Buzz, or even for Stoney to have overlooked something, some small, perhaps seemingly unimportant item at the time. He didn't believe it but he'd give it a whirl. It had happened before in flying and in space. It happened to pilots new at the game and to the old veterans. That's why the market for printed checklists was just as good today as it had been for years, and why they still made pencils with erasers.

But Pruett knew better than to rack his brains to find the straw in the haystack of thousands of events these last days. They'd set up a steady schedule for powering down the S-IVB, bringing Ironman to life, and easing away from the big station, then setting up their deorbit boost, and coming on home.

Under the pressures of their flight schedule, especially their deteriorating individual performance . . . yes, any one or all three of them could have missed up on something, somewhere. Not for a second did he believe that *he* had done so. But he had learned also, under the lash of past errors and accumulated experience, never to take anything for granted. He could permit himself the luxury of generalization. But Pruett had never been guilty of self-confidence to the extent of *knowing* that he might not slip in the meticulous schedule of their flight.

Pruett glanced at the astronaut to his immediate right. Buzz Lloyd had emerged from the somnolent state into which he had drifted. Now he pored through the master flight log of their mission, the checklists and procedures for Apollo extending for page after page. Pruett was grateful that Buzz had returned to a specific and methodical processing of actions and data. With the sure mind of the engineer and scientist, if he could concentrate as he had done for so long, he stood as good a chance as anyone of finding the flaw in their continued orbiting.

It would have been difficult, if not impossible, Pruett knew, for anyone to have studied the qualifications of his crew and say, emphatically, this one man is better than the other two. Impossible because they were all three so damned good. They wouldn't have been sent into space for a lifetime mission of six months to a year if they hadn't whipped the friendly opposition for this space journey. Not that all the other astros wanted a crack at it. For some of the more feverish tigers, the idea of spending six months in a floating tank, weightless

or not, was enough to give them the crawling shivers. Get in and get out, that was their motto. That was fine for exploring space, but it didn't hack the job for the exploitation of space, which was the only kind of payoff that would induce the taxpayers to keep shelling out. So the three men of Ironman had not only to be as good as anyone else on the team, they also had to be able to sustain their performance.

And for five months Buzz had done that until slowly, like the fabric of a fine garment coming apart, he had started to shred in the precision his work demanded of him. He fumbled instruments, manhandled equipment, made the wrong moves with switches and controls. This wouldn't have mattered much had they been on the ground. But they weren't. And in the metallic confines of an orbiting laboratory there wasn't anywhere to go to rest and take a break. You just didn't knock it off. You either swept along within things or you were on the outside, and that could kill you and the others fast, very fast, because one bad mistake up there was lethal. So Charles Keith said to bring them on home. Pruett didn't like the idea of going earthside without having met their complete objectives, but that was false thinking, since one of their major objectives was simply to find out how long they could hack the grind. He could have gone on for the full year and so could Stoney, but Buzz met his limit and that was that.

Buzz started his career as a test pilot in bombers. That was his element. Like other test pilots he could handle anything with wings on it, and he did, but the big machines were his element. As to be expected of anyone who made the grade of test pilot, he was brilliant at the controls, a near-genius in the brain department, and gifted in terms of hard experience. Gifted, because he was still alive after having swung at the toughest test pilot jobs in the business. He'd flown for the Air Force, then for Boeing where he punished big machines in attempts to near-wreck them in the air, and then he signed up with NASA. But even before he'd been a pilot he had flown for years as a navigator and set one of the finest records as a stargazer in the Strategic Air Command. That led him to his second science, astronomy. Buzz Lloyd's amateur standing as an astronomer was better than any astronaut on the NASA roster, and when he joined the ranks he was a natural for Apollo Applications. In the astronomy department, of course.

From the beginning Buzz wanted assignment to the space stations. This seemed to be in keeping with his penchant for

big flying machines, and he didn't care whether they flew on aerodynamic lift or centrifugal force. Buzz had flown as CM pilot on a lunar mission, remaining in lunar orbit for four days, alone, while the other two men grubbed around in the lunar soil. He proved just as much at home whirling around the moon as he did behind the controls of a big iron bird pushing aside molecules of air. The S-IVB tank was to Buzz only a taste of better things to come. NASA had in the works a huge space station effort that would use the S-II stage of the giant Saturn V as its base, with modules added to it on all sides until, by 1980, the station would accommodate one hundred scientists not only from the United States but other nations as well. There would have to be a Chief Astronomer on that huge tank in space, and Buzz wanted the job. If he hacked the S-IVB mission he'd be a shoo-in for the big show.

But he hadn't been able to hack it. It wasn't his fault.

The trouble was that Buzz didn't know this. And an intense sense of loyalty was tearing him apart. He blamed himself as the cause for failure. He blamed himself for cutting short the S-IVB experiment. He blamed himself for their current predicament.

When you heap that much blame upon yourself it gnaws at your vitals and makes hash of your judgment, and . . . Pruett didn't like to think about it.

Buzz had become dangerous to them. At any moment he might go completely off the deep end and pull some fool stunt that would kill all three of them.

They called him Stoney because he was unflappable. Clayton Stone, genius made of pure brass. Some of the secretaries at MSC referred to him as the Boy Wonder, although Stoney had emerged long years ago from anything that even remotely resembled boyhood. Except for his looks, Pruett had to admit. A shock of golden hair, a skin so smooth it defied the reality of Stoney's years as a fighter pilot and test pilot and astronaut. And years of marriage and a houseful of kids. And a half dozen degrees in as many different sciences.

Stoney's face hadn't changed as long as Jim and Celia Pruett had known him. He looked fifteen years younger than he actually was, and he was the only astronaut who had fan clubs of teen-age girls all over the world.

Stoney had never been in uniform. His family had a bundle of money and so long as their only son exercised judg-

ment in its use he was free to spend as much as he wanted to. Stoney developed skill and expertise at the business. Enamored of machinery, he surrounded himself with engineer friends of every description. Half of them were kooks seeking the perpetual motion machine but Stoney didn't care. He soaked up knowledge from them all; in machinery and electronics and everything else tied in to mechanical things that klunked or groaned or wheezed by day or by night. He took college courses with wild abandon, uncaring about degrees until his family clamped down with a rare show of interference and demanded sheepskins on the wall. As much to show them up as anything else, Stoney signed up for enough courses to stagger a dozen bright students and romped through them all.

A friend took him for a ride in his private jet and Clayton Stone was off and running with his newest love—the sky. He didn't want to spend the time he could spend in the air marching in ranks and learning how to salute, so he stayed away from uniform. He had the money to get what he wanted in commercial schools, and he plunged into a cruel course—self-inflicted—of flight. He went at it the right way. He combined his courses and took two years to get his private, commercial, multiengine and instrument ratings. He had the money and he had the urge and he got his seaplane and his glider ratings, and he went on to get his instructor's and air transport ratings. Immediately he looked for new worlds to conquer and went ahead with training in helicopters until he had that rating as well. He bought an old P-51 fighter and flew the hell out of it, and then he bought an F8F Bearcat and started flying air races. He won a bookcase-full of trophies, and then came out of one race in the hospital with a busted leg and assorted bruises and lacerations. All he remembered was that the engine exploded when he was too near the ground and there wasn't time to get out and he went into the ground in a screaming tangle of wreckage.

He figured he was living on borrowed time. He took jet training. There were plenty of those around. He flew Learjets, de Havillands, Mooneys and anything else he could fly. They lacked something. He bought a surplus McDonnell FH-1 Phantom jet fighter and had a ball but it wasn't enough. He wanted to go supersonic but that wasn't available on the commercial market.

His family had more than money. They had huge stock holdings and the right contacts and a big aircraft company

signed up Stoney Clayton as a test pilot. That meant more schooling, but it was the open door to sweptwing monsters and speeds several times faster than sound.

All this time Stoney had been soaking up knowledge of machinery and systems and didn't realize he was as sharp in that department as he was behind a control stick. When NASA announced they would accept civilians as astronauts, Stoney was pushing his way to the front of the line. He knew that he'd finally reached a plateau where money, stock holdings and contacts wouldn't do him a damn bit of good. Deke Slayton, one of the original Mercury astronauts and the man who ran the astronaut program, was as hard as nails when it came to qualifications for his business. Stoney Clayton made it with flying colors on his own merits.

NASA found out quickly that Stoney Clayton and machines were in the same harmonic chord. Machines held no mystery for him. He would as soon pat a huge generator on the flanks as a man would pat a dog on the rump.

Unlike Buzz, Stoney didn't care a fig about a space station. He wanted to be the Systems Engineer for the first manned station on the moon. The first permanent base that would be largely self-supporting, that would extract oxygen and water and other vital elements from the rocks of the moon. Ironman was the mission to qualify him for that job.

And for the first time his skill, his feeling, his inner senses did him no good at all. He didn't go through the manuals or the checklists as Buzz was doing. Stoney didn't need to bother. He knew they hadn't made any mistakes.

It didn't make him feel any better. He didn't need a computer to figure out that they had all too short a time left in which to breathe out the last of their lives.

Stoney had kept his silence but he fully agreed with Buzz on one point. They were crazy to sit here and gasp out their last. He knew the ground engineers would find out what had gone wrong with the big engine of their service module only by a stroke of luck. EVA was the answer. Get the hell outside and stir around in the plumbing and find out what was wrong.

And fix the goddamn thing.

Stoney didn't say anything for a while because he also knew Ted Dougherty and he knew how close Jim Pruett was to Ted.

He decided to sit it out for a while. Just for a while, though, because he knew, as well as did Pruett, that at any

moment Buzz Lloyd could come unhinged like a steam boiler blowing its top.

And Stoney Clayton wanted very much to live. If he couldn't, he didn't want to end it strapped into a seat and breathing his own foul, stinking air.

Jim Pruett turned back to himself. Dwelling on the other two men with him wouldn't help right now. Leave them be. Let them all soul-seek in their own ways. That was best. Pruett knew, also, how important it was to approach the problem of their survival from an oblique angle, to enter it slowly, treading the mental pathways with caution. Any desperate attempt to discover the error, if indeed there ever had been one, would only fog his thinking. He had to go through a mental checklist. He must unwind, relax his body as well as his mind, free himself from the tensions which had shouldered and pushed their way into his processes of thought. Only by complete objectivity could he divorce himself from the chilling immediacy of the end he faced. *They* faced. He was responsible for them, he was the commander of this—*he must relax.* For a little while, at least, he must rid his mind of the problem. He must step outside the arena for a mental moment, and then return slowly, fully in control of all his thoughts and senses. For a moment he thought of his family and quickly banished them from his mind. *That* never got a man anywhere . . .

He closed his eyes, oblivious to his plunge about the massive world. He drifted gently above his couch, sandwiched in between pressure bulkheads and humming machinery and the control panel, but absolutely free within his weightless state.

He let his thoughts drift, idly, washing gently to and fro in the memories he knew and cherished most of all . . .

Chapter IV

Early morning was the best time to thumb a ride from his home in Huntington, on Long Island's north shore, to Zahns Airport near Amityville. He didn't know how long it was from one to the other, but he guessed about a dozen miles or more, and that was too long a way to go on foot, anyway, so he learned to leave as early as possible. With the sun barely creeping over the horizon, the roads were fairly empty. But there were always plenty of trucks. Early in the day some drivers were willing enough to pick up a kid in his early teens with a grin on his face and a thumb raised in the time-honored gesture. He'd listen for the sharp hiss of air brakes and the welcome squeal of tires as the rigs slowed. He enjoyed running down the side strip, and swinging up into the big rigs with their wide, worn leather seats.

He'd tell the driver he was on his way to Zahns Airport. He said that maybe he'd even get a chance to fly, if luck was with him. Handling a huge tractor-trailer rig was a man-sized job, but the drivers were always interested, and the trips were short enough. He'd climb down, yell his thanks, and then take off in a trot for the airfield.

When he was fourteen, an older friend took Jim Pruett into the sky for his first flight. The airplane was old, its fabric a faded and splotched yellow, and the engine dripped oil on the tires and on the ground. It reeked of gasoline in flight, and it shook horribly. But the pilot didn't care, and Pruett was madly in love with the clanking, wheezing machine.

Sometimes Pruett would thumb a ride to the east to reach Mitchel Field. It was still open then and he couldn't wait to see the fighters and bombers and transports snarling into the sky from the Air Force base. He'd walk down to the road that crossed the end of the Mitchel runway and stand in awe as a fighter crashed its way scant feet over his head, tucking up its gear like a frightened bird and fleeing to the haven of the skies.

But at Zahns he could get close to the planes. He could watch the pilots shouting contact to the mechs, the wooden props swinging down suddenly and catching with a stuttering cough. He loved to stand behind the ships when the pilots revved them up for power checks. The air blast whipped back, throwing up dust, stinking of oil and gasoline. It flattened down the grass like the ears of a frightened dog and it blew strong and heady into his face.

But for too long a period he didn't fly. His friend with the clattering old airplane moved away and Pruett had to settle for the smells and the roaring engines and the wind blowing dust into his face. He'd stand near the hangars, just watching. One day a man rolled a gleaming new Luscombe out of the hangar. The wind blew strong and the man was having trouble. No one was around to help. When he saw Pruett, he called to him.

"Hey, kid! Give me a hand, willya!"

Pruett stumbled in his haste to get to the little two-place ship. He ran behind the right wing and pushed on the strut. The beautiful machine was light and easy to roll along the grass. The man said, "Thanks," and left for the flight line office.

When he returned, Pruett was standing on a box by the nose, polishing madly with his handkerchief. He'd cleaned the cockpit glass and was working on the side windows. The man watched him in silence for a few moments.

"You like a ride, son?" he asked.

Pruett's broad grin was all the answer he needed. "Okay, then, hop in."

The boy breathed deeply to soak in the smell of the Luscombe. It was a new ship, everything clean and sparkling. The two seats were side by side, the instrument panel dazzled Pruett, and with great care he ran his fingers over the rubberized grip of the control stick on his side of the airplane.

Twenty minutes later they were at six thousand feet, drifting lazily above white puffs of clouds. Pruett hadn't said a

word, but his eyes were glued to every movement the pilot made. He couldn't believe it when the man turned to him. "Want to try your hand at it?"

"Y-yes!"

The pilot laughed. "Okay, but remember, she's real light and sensitive on the controls. Handle her real gently."

His hand trembled slightly as he closed his fingers around the grip. The pilot grinned at him and held up his hands to signify passing the controls. Pruett swallowed hard, afraid to believe he was really *flying* the airplane.

He wasn't. He was manhandling the Luscombe. You don't push one of those airplanes around; you breathe your wants and desires, and the silver machine responds with obedience. Ten minutes after he started, the pilot took back the controls from Pruett.

He landed at East Hampton, far out on the island. "I'll be back in a little while," he said. "Stick with the airplane and don't let anyone fool around with it."

An hour later the man was back, and they were at the end of the runway. "Hang onto the stick lightly, and put your feet on the pedals," the pilot ordered. "Now, you can follow through with me on the controls, and really get the hang of it." Pruett nodded. The Luscombe bounced down the strip, and Pruett hardly noticed the slight nudge of the stick toward him. But the airplane responded and soared away from the ground.

They were thirty miles out of Zahns when the pilot told Pruett to be sure his seat belt was cinched tightly. "Ever do any aerobatics, son?"

"No—no, sir, never did anything like that."

"Okay, hang on. And tell me—right away—if your stomach starts to slosh around too much."

The sky vanished. Pruett stared at a vertical line where there had been sky, and realized with a start that the edge of the world, where there had been a horizon, now stood on its end. But not for long, as the Luscombe continued on over, rolling around the inside of an invisible barrel in the air, until the ground was up and the sky was down. He had just enough time to catch his breath when the nose went down and a hand pushed him gently into his seat and glued him there as the nose came up, and up. The horizon disappeared again and the engine screamed with the dive. Then the nose was coming up, higher and higher, and the engine began to

protest the pull against it. The sun flashed in his eyes, and Pruett found himself on his back as the Luscombe soared up and over in a beautiful loop.

There was a lot more to it, and Pruett's eyes were glazed with delight and wonder when the silver airplane whispered onto the ground at Zahns.

There could be no stopping him after that delirious flight. He lived and slept flying, and drove his parents near distraction with his long absences from home. He lugged home books from the library and stayed up long hours into the night. In his reading he mixed adventures and dramas of pilots with serious studies of aerodynamics. He plunged into the world of flight with an exhilaration that ebbed slowly and only after he began to accumulate a growing number of hours at the controls. He replaced exhilaration with eager competence.

He worked every afternoon when he left school. He scrimped and saved, and he took a job on Saturday night in addition to his after-school work. He spent every weekend he could at Zahns Airport, and did odd jobs there as well. He accepted his pay in flight time; as little as fifteen minutes made it worthwhile.

On his sixteenth birthday he had ninety hours logged in his book, and he almost flew home on his private cloud. For he soloed that day, and there is only one first solo for any pilot, anywhere.

He went straight from graduation ceremonies at Huntington High School to the Air Force recruiting station where he begged for flight cadets. He had four hundred hours logged by then . . .

The months fled by and suddenly he pinned on his gold bars as a spanking-new second lieutenant, and with deep pride wore the silver wings on his tunic. As quickly as he could he slipped from the flight line ceremonies back to his room and closed the door.

He stood before the full-length mirror. It didn't seem true, not really true.

"James R. Pruett . . . *fighter pilot,*" he breathed. He stared at the image for a long time.

He went on to advanced training. There were still a few long-nosed Mustang fighters around, sleek brutes with fifteen hundred horses and a massive four-bladed propeller. Standing by the gleaming nose, he ran his hand hesitantly along one of

the four big propeller blades. He spent an hour with the machine, in love with its lines, burning with desire to take it into the air.

He ran his instructors to exhaustion. He couldn't get enough of the Mustang. It howled with energy, it was a bitch and it was lithe and tigerish and deadly, and it seemed a fulfillment of all the hours that had brought him to this airplane. He took to mock dogfights with a fury, and within several weeks had turned aggressor against his instructors, who discovered quickly that the young lieutenant seemed as much a part of his fighter as the engine.

Pruett was more than a natural pilot. He was a brilliant, natural pilot who combined these characteristics with technical skill.

Then Pruett got his smarts. He'd decided already his goal was that of a test pilot. The cockpit took you only so far. The rest of the way could be earned only behind a desk. Sweptwings, mach numbers, compressibility, turbofans—the lexicon of the budding new age was both exciting and a warning. Exciting because of the new dimensions of flight that lay just over the horizon; a warning because being a pilot wasn't enough. Not any more. You had to be strong in the brain department as well.

Pruett entered the University of Minnesota and cut himself a wicked schedule. Other pilots had done it; he could match any one of them. He took the full four-year course and doubled up on all his classes. The outside world seemed to merge into a fog that swirled around his new life, and he ignored it almost completely. Two years after signing up at the university, he graduated with a degree in aeronautical engineering.

He paused only to catch his breath, and signed up at once for additional work. A year later—and fifteen pounds lighter than when he first came to the university—he had his master's degree in aeronautical engineering.

The Air Force told him to wait for a recall to active duty. Pruett went home. He was grateful for the respite from the grueling pace he'd maintained for three full years. He was content to spend his days in lazy relaxation. There was plenty of fishing, and sailing, and mild surprise at the way the girls he'd known in high school now filled their tight dresses. But there was one girl in particular. Celia had always been a person apart from the others he'd known and whom he had dated, and while neither of them broached the subject directly, the assumption rested quietly between them that mar-

riage waited at some time in their future. Celia had never pushed, and even in her unconcealed deep pleasure at greeting Pruett, she was certain, as always, to keep their relationship unstilted and undemanding.

Yet she was, as she had been, uninhibitedly frank with him. And it was at her open suggestion that Pruett borrowed a small cabin cruiser from a friend, and he and Celia disappeared for a week all to themselves.

When they returned, Pruett found a letter waiting for him. It was from the Pentagon. He was to report for active duty in sixty days. Pruett shouted for joy.

He decided to celebrate in the way he knew best. By flying. He drove to Zahns, content for a while to walk around the field, just looking at the dozens of planes lined up on the grass.

Then the old hunger in his belly came back. The sight of small airplanes bouncing across the field reminded him of his own student days, and he grinned at the familiar stink of oil and gasoline. Ed Lyons, one of the airport owners and the man who ran the flight school, had four new J-3 Cubs for student training, but Pruett paid them little attention. He walked into a hangar and stared at a gleaming red-and-white Stearman biplane. It was a pilot's dream. This was no ordinary Stearman; he saw that at a glance. The engine was bigger than he'd ever seen in one of these, and the entire airplane was waxed and glossy. He noticed immediately the structural beefing on the airplane; he could tell that this machine had been modified for a pilot who liked to throw it and himself around the sky.

He heard footsteps behind him. He turned to meet a broad-shouldered man in greasy clothes. The man jerked a thumb at the Stearman.

"Like it?" he asked.

"Christ, yes. I've never seen a ship quite like this one before."

The man laughed. "That's for sure, because there isn't anything else like it. I rebuilt this airplane right here, stressed it to take just anything a pilot could do to it. It's one of the best aerobatic ships in existence. Say—" he looked at Pruett closely, "aren't you Bob Pruett's son?"

Pruett shook hands with Ed Lyons. "Your old man tells me that you're quite a pilot," Lyons said.

"No, I think that's going a bit too far," Pruett replied. "I can handle an airplane with a lot of them, but as far as I'm

concerned, I've just about opened the door. But one good thing is in my favor," he grinned. "The Air Force trusts me with their iron birds."

They sat in Lyons' office, drinking coffee and discussing Pruett's flying background. Lyons stood up suddenly. "Want to go up with me in the Stearman? I'd like to see how you'll make out with her."

"You're *asking* me if I want to fly that airplane? Don't ask twice—let's go!"

Pruett knew that he was with one of the true "old-timers" of aviation. His father had told him about Lyons' background, how he had flown around much of the world as a soldier of fortune. No one really knew how many hours Lyons had spent in the air, and the pilot couldn't have cared less. He was rated for just about everything that could get off the ground.

In 1937 Lyons had flown Russian Katushka attack bombers in Spain and petrified a succession of rear gunners by flying below treetop height, screaming through narrow mountain passes in vertical banks, because there wasn't enough room to get the airplane through in level flight. He would bring the powerful Katushka to point-blank range when he went in after his targets, almost as if he were trying to decapitate enemy soldiers with the flashing propeller.

With four big guns firing forward in the Katushka, Lyons would grin when opposing fighters bounced him. The Russian biplane was considered duck soup by the enemy fighter pilots, for most of the Katushka crews would simply run for it when they were caught by the smaller, faster airplanes.

Lyons didn't know how to run, and he *did* know how pilots were prone to think. They got careless when they encountered the heavier and slower Katushkas. These facts were all weapons to Lyons. Also, he was one of the great masters at aerobatics, and he could do things with the Katushka that other pilots said were impossible.

He suckered in the opposition. He threw the Katushka into a dive when the fighters came roaring after him, but a dive that curved slightly in its path and that put him into position for a wild and skidding turn. He timed it with precision, skidding just beyond range of the enemy guns, bringing the nose of the Katushka around. Which brought the four heavy guns into position to lead a fighter. Lyons chewed the enemy airplane from nose to tail, walking the rudder pedals to get a buzz-saw effect from the guns. This also gave his rear gunner

a chance to get in a few licks. Faced suddenly with a demon coming at them in fighter fashion, the enemy pilots almost always forgot about the man in the rear cockpit with his twin guns.

Before he left Spain, three fighters went down before his forward guns. His rear gunner flamed two more. Besides this astounding record, Lyons sometimes used the Katushka as a fighter by diving full speed into enemy bomber formations. He shot four twin-engine bombers to ribbons in the air.

And all this was back in 1937 when, Pruett realized, he was still dreaming about the sky . . .

Pruett was better than good. Despite his disclaimers to Lyons, he had come out of flight cadets as the head man in his class. He had everything going for him as a pilot. The Stearman wasn't new to him—he'd flown one in cadet primary training. Of course, it wasn't anything like this airplane, with all the extra work Lyons had done to it. He immediately noticed the huskier cry from its engine. It was tougher and stronger, and rode the choppy turbulence at low altitude with a feeling of great solidity. It was spectacular in its response to the controls. The barest touch of the stick brought about an instant reaction with a wing snapping up or down. Pruett had never imagined such sensitivity.

As Lyons climbed away from the strip, Pruett adjusted his leather helmet and goggles and plugged in his intercom jack so that he could talk directly to the pilot behind him. They went to seven thousand feet over the island's south shore, and Lyons gave him the controls.

"Go through whatever you'd like," he said. "And don't worry about the stress loads with this airplane. Okay—" he held his hands above the cowl, "she's all yours."

Pruett was in heaven. He ran through the book—slow and barrel rolls, Immelmans, falling leafs, chandelles, snap rolls . . . he went through cloverleaf turns, figure eights, loops, everything he had ever known in the manual on aerobatics. He did it all with great precision, enough to satisfy the roughest instructor he'd ever known. And he had run more than one instructor ragged in mock dogfights.

"Not so bad, not so bad," Lyons commented as he took the controls.

"Whaddya mean, not so bad?" Pruett retorted. "Where did I drop the ball?" Lyons' remark irritated him. Hell, he'd flown that Stearman with absolute precision through *every* maneuver.

"Anyone can run with the ball, my friend," Lyons said quietly. "Anyone can do that. It's a matter of practice, that's all."

"Hey, now, I don't want to be hard-nosed about this, Lyons, and you are a friend of my old man—" he grinned to himself, "but if I'm such a slouch, why don't *you* show *me* how to fly?"

There was only silence from the rear cockpit. Pruett couldn't resist laughing aloud. After all, any man would be just a bit weary after all those maneuvers he'd flown. And Lyons *was* quite a few years older. But Lyons had stuck in the barb, and Pruett couldn't back off from rubbing things in a bit himself.

"C'mon, old man," he shouted, "*show* me!"

Lyons didn't reply. Instantly Pruett regretted his words, for they had been unkind, and the man had done him a favor by taking him up in the Stearman. He started to apologize.

He never said a word. He *couldn't.*

The world vanished explosively into a blurred streak of sky, sun, water, and earth. Pruett didn't even know what Lyons had done, but in an instant he transformed the Stearman into a living creature. He barely had time to whisper, *"Good God!"* to himself as Lyons blended his hands and feet and personality into that of the gleaming biplane, until man and machine were a single entity.

The airplane sang its cry of flight as Lyons flashed through his maneuvers. He didn't fly through a transition of one maneuver to another; it was all a constant, fluid motion without a single instant of hesitation, a flowing movement of glimpses of the sun, streaks of blue water and green earth, and a steadily shifting series of pressure movements against his body.

The snap rolls were unbelievable. The Stearman plunged for the earth, then sailed up and around in a towering loop, wind sighing through the wires. She seemed to poise at the very top of the earth, bathed in sunshine and sprayed with cool air. She floated up and over on her back, contemptuous of all that lay far beneath her, and then the stick moved and the rudder pedals danced, and Pruett realized that Lyons was taking her—at the top of the loop!—through three consecutive, perfect, snap rolls. The Stearman came around through the third roll and the stick was coming back again and the airplane whistling earthward in its curving, inverted dive.

Then the earth returned to where it belonged, and the rising and falling keen of flight from the engine steadied down

to its familiar drone. Pruett took a long and a deep breath, letting it out slowly. Never for a moment had he imagined that flying could be like *that*. Good Lord, why—why, compared with the skill in Lyons' hands and feet, Pruett was a stiff-limbed neophyte who could barely get off the ground. And he had called him an "old man," and dared Lyons to show him—bigmouth Pruett—how to fly.

The gleaming wings eased over to the left into a turn. Lyons steepened the bank until the wings were almost vertical, the agile biplane clawing around tighter and tighter. Pruett glanced down and saw the mud-green lines of the little airfield. He—

His muscles tensed. The Stearman was starting to shudder —little motions, light slaps against the wings and body. The buffeting became more pronounced. Lyons was getting into a stall with a steepening bank, and he couldn't even feel it happening. Pruett started to shout a warning; any second the higher wings would stall out and—

Too late! The Stearman tore herself out of her pilot's hands. With a wicked, jerking motion the biplane clawed up and over on her back, flipping around. The nose plunged, and the earth whirled giddily as the Stearman fell toward it in a spin.

Lyons made no move to bring it out . . .

The whirling earth rushed up at them. They had only seconds before it would be too late to come out of the spin! Frantically he grasped for the stick, but it moved suddenly of its own accord. He felt the rudder slam hard over and the stick snapped forward. With the precision of a machine the Stearman cracked out of the spin and glided forward.

Pruett couldn't believe what he saw. The edge of the runway slipped beneath the wings, and the Stearman sighed gently, almost happily, as the wheels kissed the grass in a whispered landing.

"Hey, Hotshot!"

Pruett didn't answer. He was still too overwhelmed with the entry into the spin, the dizzying whirl earthward, his sudden moment of complete fright, and the unbelievable skill that Lyons demonstrated in snapping out of the spin and onto the runway . . .

"Hey! You back there! Are you still alive?"

The stick banged violently from side to side, cracking against his knees. He grabbed for it to stop the beating.

"Well, well. It's good to have you back with me, Ace,"

Lyons rasped. "Do you think that with all your Air Force experience you might be able to taxi this thing back to the hangar?"

Pruett didn't answer. By way of reply he eased the throttle forward, taxiing in a weaving pattern to the gas pit. He locked the brakes, opened the mixture control until the engine starved for gas and coughed to a stop. He killed all the switches, pulled off his helmet, and climbed slowly to the ground.

Lyons waited for him, fists on his hips and his head cocked to one side. Pruett, embarrassed, walked up to him.

Lyons shoved a thick finger into Pruett's chest. "*You*, my young von Richthofen, are going to buy *me* the biggest steak dinner that it is possible to find anywhere on this island. Right?"

Pruett nodded quickly. Lyons roared with laughter, and spun on his heel. Pruett followed quietly into his office.

That evening—over steaks and a tall bottle of wine—they talked flying. Pruett was shocked at his own lack of knowledge. He had over a thousand hours logged, a master's degree in aeronautical engineering, he was an Air Force fighter pilot . . . Lyons didn't wave all this away, Pruett noticed gratefully, but neither did he accord Pruett's background any special significance.

The older man tapped the table for added emphasis. "Jim, you're a good pilot. Really good." He smiled at Pruett's sudden glance.

"Never mind the ribbing you took in the airplane," Lyons explained. "You weren't the first and you won't be the last. But you *are* worth working on. You have excellent timing, you understand precision, and you have, above all else, what I call an identification with the airplane."

Pruett listened carefully. "Go on, Ed."

"But you have faults. Oh yes, you have faults. All that engineering is actually getting in your way."

"How?" He was puzzled; how could knowledge of aeronautical engineering interfere with his flying?

"Oh, it doesn't interfere with your flying an airplane in an excellent fashion. No, you'd make any inspector a happy man. You fly that thing exactly as the book says it should be flown. *That's* your trouble, Jim. Flying by the book is fine, until you really start to learn how to fly. You can't be expected to notice the little things until you develop a special

sense for them. When you're learning, you must concentrate upon the airplane, upon what it does, how it reacts. Sure, I know what they teach you. 'An airplane is a mechanical device, and it will always respond in a specific manner to mechanical laws.' Hell, boy, the Wright Brothers knew that, too.

"*But*—and this is a very big *but*—you must finally reach a point where you no longer think consciously of these things. I don't mean you are to forget them; that would be stupid, and you'll kill yourself one day.

"You've got to take all that fancy knowledge they crammed between your ears and make it second nature. You've got to stop flying with a slide rule. You can fly with great precision that way, but you're never going to get one inch away from the book. You're going to be a wonderful, excellent, by-the-book flier."

"And that's bad?" Pruett countered. "What's wrong with trying to be as perfect as possible with the controls? Hell, Ed, it's guys like you who wrote the book. If the book isn't any good, how come we're paying so much attention to it?"

"And who says the book isn't good?"

"Why—*you* did, just now," Pruett said in surprise.

Lyons drained his wineglass and held it out for Pruett to fill. "You've got too much learning between the ears, boy, and you do *not* listen very carefully. I said the book was fine, but only up to a point. After that, well when you've got to graduate into the next stage."

"Which is?"

"The book and everything in it must become second nature, just as I said. You don't think consciously about it; it becomes like—well, osmosis would be a good term for it. It must become as natural as walking. You don't think about balancing yourself when you walk; you just do it naturally. But every child must *learn* to walk. Right?"

Pruett nodded and remained silent.

"Good! We're getting through to you, then. Now, for the rest of his life, the child-boy-man no longer thinks directly about his balance when he walks or runs. Even when he's in trouble, everything is reflex action. When he's dizzy, for example. He doesn't try to keep his balance mechanically. It's a reflex, an instinct.

"And that is what flying must be to you, if you want to be something more than a mechanical pilot."

The wineglass waved in front of Pruett's nose. He emptied

the bottle and signaled the waiter for another. "Well, I'm glad to see you've got good instincts when it comes to good wine, anyway," Lyons said.

"Now, we talked about the book, and you made nonsense about old-timers who wrote it. That's where you're making your mistake, Hotshot."

Pruett winced.

"Your mistake is that you're accepting the book as the final word. It's not the final word by a long shot, and it never will be. Because we're still rewriting it, we're changing it, and we're adding things to it. Because good pilots with twenty thousand hours are still getting killed, and the book doesn't help them at all. The book, my fine young friend, is a guideline. It goes only so far, and then—well, then you've got to carry on to the next step. And your classroom is in the cockpit." He pointed with his finger, and Pruett looked up. "That's right," Lyons said softly. "Up there—the only classroom that counts."

Later they drove back to the airfield so that Pruett could pick up his own car. He was closing the door when Lyons beckoned him closer.

"How long before you report back for active duty?" he asked.

"I've got about six or seven weeks left," Pruett said.

"Not much time, but maybe we can do something before you return to those iron monsters you kids are flying today." Lyons was silent for a few moments; Pruett waited, not interrupting his thoughts.

Lyons looked straight at him. "Be here tomorrow morning," he said. "And be here at six o'clock—*sharp*." He roared off before Pruett could say a word.

It had been a long day, he mused, as he drove home. Hotshot Pruett, and Lyons had made it all too clear that Pruett was still wet behind the ears. Damn, but that man could *fly* . . .

The next morning he was at the field at five-thirty. Before Lyons drove up, Pruett had the Stearman out of the hangar. He'd drained the sumps and checked the airplane over carefully.

When Lyons walked to the hangar, Pruett bowed low and intoned: "Greeting, O Master! Thy pupil awaits thee."

Lyons grinned at him. "You learn fast, Hotshot. At least you've got the right attitude." He glanced at the Stearman. "All checked?"

"She's ready."

"Good, I'm not." He tossed a ring of keys at Pruett. "Open the office and make us some coffee. That's the first step in becoming a good pilot." He disappeared within the hangar.

During the next six weeks Lyons hammered at him. He gave Pruett no quarter, allowed him no excuses, shouted and cursed at him for the slightest infraction of Lyons' orders. He was merciless, and he knew how, with the barbed needle of the veteran, to bring Pruett's temper to the boiling point. Whenever that happened, and Pruett began to turn crimson in his rage, Lyons would shove his face against Pruett's nose and talk in a voice like sandpaper.

"What's the matter, Hotshot? Too much for you? You're a great big pilot who knows everything? Maybe," he sneered, "you want to teach me instead? How about it, Hotshot?"

And always in time Pruett cooled off and held his tongue. For this was as much an element of his maturing as anything else, he realized. Lyons needled him at every opportunity on the ground and in the air. Once, coming out of a series of maneuvers, he brought his pupil to the point of choking with his rage.

Immediately Lyons passed the controls to him. "Okay, Hotshot, since you're a tiger today, let's see how you can—"

He rattled off a series of demanding aerobatic maneuvers and ordered Pruett to perform them with absolute precision. Pruett tried but failed, his body flushed with anger. He vented his rage on the airplane, and the airplane, of course, flew like a truck. To show his disgust, Lyons would grab the stick and bang it back and forth, pummeling Pruett's thighs and knees.

He had welts and bruises in profusion when the light dawned. Lyons was delighted when Pruett accosted him in the office and insisted on a blunt talk. He asked his tutor if the needling was intended to sweep him into anger.

"Whatever gave you that idea?" Lyons queried, his voice suspiciously pleasant.

"Because, goddamn you, you always give me the stick whenever we have a fight, and you insist that I go through those maneuvers, and you know goddamn well that that's the worst time for—" His voice trailed off slowly.

"Oh. I see," he continued quietly.

"You see *what?*"

Pruett looked like a kid with his hand caught in the cookie jar. "You've worked that needling bit to a fine perfection, haven't you?"

"Who *me?*" Lyons asked.

"Yes, you—you old reprobate. Now I see what you've been doing to me all this time. Why, you've been doing your best to get me mad!"

"And, if you will notice—" Lyons drove the needle in deeper, "I have been very successful. What else have you learned today, Hotshot?"

"You know damn well what I've learned."

"That's right, Hotshot. You've been letting your anger get the best of you. You've been a simple-minded ass who forgot he was a pilot who knew how to handle a plane. And you were flying that airplane like you were kicking a dog that had leaked all over your new pants.

"You ever do that in combat, Hotshot, and you're a dead man." He said it slowly, softly. "A very dead man."

Pruett asked him to continue.

"That part of your schoolwork is over," Lyons said. "But you had to learn it the hard way. There's nothing wrong with anger, or fear. They kick your glands in the slats and they shoot adrenalin into you like it was coming from a fire hose. It whips you into a fine pitch, if—and *only* if—you still stay in control."

Pruett slumped in his chair and waved an arm. "And all this time, when you stuck in the needle, I twitched, just like a Pavlovian dog." He screwed up his face. "Okay, Ed," he sighed, "I've learned my lesson."

"Mr. Pruett?"

"Yeah. What now?"

"*Mister* Pruett, I think you will be pleased to know that a certain Mr. Hotshot has departed these premises."

Pruett looked up, eyes wide. Lyons held out his hand and Pruett shook with him.

"Today is graduation day, young friend," Lyons said. "I don't think the needling is ever going to work again. Now, since you've proved you're so smart, go make us some coffee."

They had three weeks before Pruett had to leave, and they were in the air as often as the weather permitted. Lyons dropped the needle, and they settled down to hard, unremitting work. Pruett uttered silent thanks to the older man, for he realized the priceless gift that Lyons was bestowing on

him. He was infusing Pruett with the best that he—Lyons—had to give. And it was a priceless gift that very few pilots ever earned for themselves.

Unlike many pilots, Pruett liked spins. He seemed to have no sensory endings in his stomach as he whirled and spun, rolled and dove, soared and skidded happily in the sky. If Lyons had been rough before, he was brutal now in his demands. But Pruett no longer took offense at the shouts and profane cries that Pruett was a clumsy, ham-handed ox. Lyons was driving him as hard as he could, and this in itself was the greatest and most constructive compliment that he could have paid the youngster. It could mean only that Lyons had judged him capable of trying for perfection, the never-attainable but always-sought level of skill. Judged him capable, but not yet there.

As an Air Force fighter pilot Pruett was fully qualified for instrument flight. Using the gauges for reference to an outside world blotted out by clouds and fog, he flew with skill and confidence. He had a flair for instrument flying; he was able to switch his senses almost instinctively from a view of the outside world to the universe enclosed within his cockpit and represented by the glowing dials and needles. In cadet training, his instructors had been visibly impressed by his obvious skill.

His instructors had been impressed, but Lyons wasn't. Before Pruett left for the Air Force, Lyons drove home another hard lesson that would prove invaluable for all the years to come. The Air Force trainers and fighters that Pruett had flown were extensively equipped with instruments; flying on the gauges was a snap once you got the hang of it.

Lyons put an opaque hood around the front cockpit of the Stearman, blocking out the world to his student. Pruett stared at the naked panel. Lyons had taped over the artificial horizon, the directional gyro, the navigational homing instruments. He left uncovered only the magnetic compass, the airspeed indicator, the altimeter, and the needle-and-ball for judging banks and turns. Nothing with gyroscopic action was left for him to scan.

The altimeter read 8,000 feet when Lyons passed the controls to him. Sealed beneath the hood, Pruett followed instructions to fly different courses, to make climbing and diving turns. Lyons ordered steeper and steeper turns. The course changes came more quickly, more demandingly, and

Lyons began to mix the instructions into a batch, ordering changes even as Pruett was attempting to follow a previous command.

His temper grew, until he recognized the danger signs and forced it down again. He'd learned that Lyons never did anything without a reason. Twenty minutes later, Lyons drove home the lesson, leaving Pruett badly shaken.

For those twenty minutes he tried to follow Lyons' constantly changing orders. The minutes melted into a blur, and beads of sweat began to collect on his upper lip and on his forehead. It was difficult, almost impossible flying. And it was *hot*; he didn't know that Lyons had opened the blower that sent warm air across Pruett's feet. Lyons *wanted* Pruett to be hot, wanted him to sweat.

The perspiration dripped into his eyes, blurring his vision. Pruett kept his left hand around the throttle, released the stick for a moment to wipe away the sweat.

"Keep your goddamned hands on the controls, you young fool!" Lyons' voice crashed into his ears. "You idiot, you're on instruments, you're in trouble! *NEVER* take your hands off the stick, you stupid idiot! Fly your airplane!" The stick cracked hard against his knees. Pruett groaned, but grabbed the stick at once.

He couldn't see, of course, that Lyons had directed the Stearman into building cumulus clouds. He kept hammering his orders at Pruett, and the airplane began to rock and pitch wildly. The magnetic compass was useless as it bobbed and whirled in its cage. The needle moved from left to right as the wings rocked and the nose yawed wildly; the ball in its curving tube was a wild thing as the Stearman skidded and slipped, and Pruett fought desperately to fly according to Lyons' roared instructions. And it was *hot,* so damned hot! The instruments were useless to him, he had no conception of up or down, or right or left, and he never heard the warning sounds about him as the engine began to scream and the wires shrieked with the increasing wind.

The warnings came to him too late, for his head was spinning, and he knew, for the first time in his years of flying, the sickening maw of vertigo. His balance organs were all scrambled, his head spun, and he was drenched in his own perspiration. The sounds of the engine and wind blended into a terrible high-pitched cry.

He jerked back on the throttle, for he knew that if nothing

else the airplane was plunging earthward. He stared in disbelief at the airspeed indicator. The needle was far beyond the yellow caution line; it had swung through the red line of Never Exceed speed, and was beyond even that mark. *And he had never noticed it . . .*

The stick slammed painfully against his knees and he relinquished the controls. Lyons ordered him to slide open the hood. He couldn't believe it. The Stearman was over on her back, howling earthward in a dive.

Pruett hardly spoke for two days. For the rest of the week a grim-faced Lyons made him fly on instruments, but on the old, classic panel of the needle-ball-airspeed-altitude.

And one day, when Pruett eased the Stearman back to earth, he realized that something very special had happened. In the office, he turned suddenly to Lyons.

"Ed, it's just come to me."

Lyons was busy devouring a doughnut. "*What's* just come to you?" he asked between bites.

"Today, Big Man Who Flies . . . today was the first time since we started this torture session that you didn't yell at me. My God, you were actually pleasant up there! You didn't defame my ancestry, or call me an idiot, and you didn't use even one little dirty word."

Lyons slurped coffee and raised his eyebrows. "So what?"

"Didn't you have anything to bitch about?"

Lyons tossed the empty cup into a basket. Very slowly he pulled the wrapper off a cigar. He bit the end, spat the tobacco in the direction of the discarded cup, lit the cigar, and slowly puffed clouds of blue smoke at Pruett.

"Nope."

Pruett's face split into a wide grin. "You mean—?"

"That's right, boy. Graduation day is here. You just might survive your next flight all alone. Welcome to the club, pup. You have just completed Lyons' kick-'em-in-the-ass flying course."

They had a wild celebration that night. Lyons saved the best of it for the morning. When Pruett showed up at the field, he was surprised to see a second Stearman parked alongside the airplane he'd flown almost steadily for six weeks.

"Today we are through with instruction," Lyons explained. "Today is—well, today's the graduation ceremony. You are going up in Old Reliable—" he pointed to the familiar Stear-

man, "while I shall fly in the Yellow Peril, over here. And then we are going to have a fight. There's radio in both ships; we'll talk on unicom."

They squared off at six thousand feet. Both airplanes roared at each other, head-on. Then Lyons' voice crackled in his earphones. "Okay, break to the right—*now*."

Both Stearmans whipped around in vertical banks, the opening play in the dogfight to follow. Pruett knew he was truly on his own when Lyons flung after a final gesture. "Let's see how you stack up against an old man, Hotshot."

Pruett chortled at the name Lyons hadn't used for weeks. "Okay, Pop," he shouted into the mike, "hang onto your cane . . ."

It was the pinnacle of flight. Two men, each with an airplane strapped to his back, each instinctive in his reaction to his machine and the pressures of flight, each honed as near to perfection as a man can be. Only, one had a slight advantage over the other; Pruett knew all that Lyons could teach, except one thing—the *knowing*, deep inside the belly, and far down in the skull, of what it feels to have enemy guns ripping up your own airplane.

They went wild for nearly an hour. People on the streets and the roads stopped to watch, staring into the sky as the two airplanes wove a tapestry of magic in their flight. They were like butterflies one moment and snarling dogs the next. The finale came when Lyons ordered Pruett to swing around to his tail. Could he stay with the other airplane? Lyons would use every trick he knew, and he might even invent a few, as he tried to shake his "pursuer."

He couldn't. Pruett clung grimly to the other airplane, never conscious of the movements of his hands and feet, flying instinctively, never allowing the other plane to get away from him, to escape his dogged pursuit. Whatever Lyons did, the pupil matched. Whatever Lyons planned, the pupil anticipated. It was almost as if the same man were flying both airplanes, so well matched were the skills of both pilots.

Suddenly the yellow Stearman staggered. Pruett stared in horror as the biplane flipped crazily, then tumbled in a wild cartwheeling motion, completely out of control.

"My God," Pruett whispered. The biplane tumbled helplessly. Pruett banged the throttle forward, diving after the other airplane. He didn't know that he was shouting Lyons' name, crying out to him.

And he was stunned when suddenly the other Stearman flashed upward, wheeled beautifully down and around in a wicked loop. Pruett turned around to see a biplane sitting only a few feet from him, propeller gleaming.

His radio came to life. "And that, young friend, was the final lesson. Never, never believe anything you see in a fight. The other guy is always dangerous until you see the airplane come apart in the air, or until it crashes, or you see the guy jump."

Lyons hesitated a moment. "Let's go home, Jim." Then, almost as an afterthought: "I hope you never have the need to remember—to use—what you just learned."

They sailed home, wing to wing, tucked in tight, and they were in the same position as the four wheels of both planes whispered together onto the grass.

Ed Lyons proved to be wrong. There did come the need to remember that "final lesson." It saved his life.

It happened at 43,000 feet, and it was some years later. It was a lousy, steaming place called Vietnam.

Pruett was second man in a two-plane element of F-104 Starfighters flying high patrol near the DMZ. The '104's rarely saw direct combat action because the MiG fighters were busy chasing after the fighter-bombers going in on the deck. But some of the Russian fighters had been messing around B-52 formations and the Air Force decided to keep the enemy a bit off balance.

It happened the other way around. Four MiG-21's came out of the sun from well above them and before they knew what happened Pruett's wingmate was a ball of flames hurtling from the sky. For unnumbered seconds Pruett tried to stay with him, to keep the MiG's off him so the other man could punch out of the blazing wreckage. He knew it was futile, and that he was about to become a second victim, when cannon shells exploded against his tail.

They were down to thirty thousand when Pruett went crazy. The MiG's tried to scissor him from atop and below but they couldn't handle the whirling dervish that exploded in their midst. Pruett was alone in the midst of a hornet's nest and suddenly the hornets couldn't handle what they'd started.

Pruett took his razor-winged fighter to point-blank range, something they didn't teach in the fighter schools any more. The MiG-21 was a superb fighter but Pruett had a good air-

plane going for him and he was a superb pilot. The others weren't in his league. He abused his airplane but it was meant to be abused and it took everything he inflicted on it.

He came out of a rolling turn to find two fighters before him. The heavy cannon in the belly of his F-104 coughed in a stuttering scream. First one, then the other and Pruett wasn't waiting to see what was happening, because he was already rolling away and the tracers that flashed near him were far enough to miss. The two remaining MiG's figured they had him boxed. They almost did.

Normally he would never have stood a chance. But he wasn't the normal fighter pilot any more. He'd been shaped and formed by one of the greatest pilots of all time, and he remembered, with amazing clarity, Ed Lyons' "final lesson."

He timed it with precision. He waited until the tracers flashed again, waited until the MiG pilots were certain of their kill, and then his Starfighter lurched, and tumbled out of control. It flipped on its back and whirled crazily, rocking dangerously. The wild forces in the cockpit dug at him cruelly, but he hung on. One of the MiG's followed him down to watch the airplane and its dead pilot. And suddenly the '104 was clawing around, reborn, and Pruett watched with satisfaction as his cannon streamed explosive lead into the MiG cockpit, and he saw a froth of red amidst the exploding glass before the fire blotted out all sight of the airplane.

The other MiG fled.

Pruett was the only pilot of the Vietnam war to score three kills in a single fight. And he made his kills in a four-to-one fight.

He wrote that night to Ed Lyons. His letter was brief, but he didn't need many words to tell what had happened. He didn't use words that thanked Lyons—not in the usual way. He just told him how it went, and he related the episode of the "final lesson."

Years later, when he drove to the field on Long Island to visit his old master and close friend, he stared for a long time at the wall over Ed's desk. He felt a lump in his throat.

There, in a simple frame, was his letter.

Chapter V

Ironman One drifted in attitude-free flight. The machine remained powered down, almost in a state of mechanical suspended animation, its electrical pulse reduced to the barest level needed to sustain its three human occupants with the essentials of survival. The reaction thrusters gaped cold and silent at vacuum, and the spacecraft with its three terribly isolated members of the human race fell around the massive world. The sun gleamed nakedly across the rounded sloping surface of the command module within which drifted the three men; it shone on the cylindrical flanks of the service module and reflected off the flaring combustion chamber, the silence of which was now squeezing its lethal penalty on three men named Pruett, Lloyd and Stone. The sun splashed nakedly across half the capsule and the service module; the other half lay in shadow and the pale bluish-green reflections from the planet below.

The spacecraft, thirty-four feet from the exposed docking mechanism to the perfect circle of the combustion chamber that gaped silent, was not alone in its orbit. Drifting around the machine were thousands of tiny particles. Frost and ice, some shaped like terrestrial snowflakes, others looping in form as curlicues, and more, an infinite variety of forms, all sailing in a great swarm around the spacecraft. Ironman One in the miraculous web of interwoven forces existed as the hub of a limited universe, and the frosty shapes orbited slowly around the machine and its subdued men.

From a vent in the side of the spacecraft, steam issued forth into vacuum. It did not emerge as steam; venting from the system that eliminated overboard excess liquid and the heat created by the bodies of its occupants, it touched vacuum and instantly froze into frost and ice and added to the drifting swarm.

The occupants of Ironman One saw none of this, cared not at all for the processes which they simply accepted in the many mechanical functions. As the spacecraft drifted, rolling and turning with the slowest of motions, so drifted the thoughts of the men. One of those men, Jim Pruett, was pursuing this course with careful deliberation. He was, he knew dimly, following the course that would bring him to the present. It was a circuitous route of the mind, but he did not object. He gave his thoughts free rein, and he recalled those initial steps that, through the ensuing years, had brought him here—in time and in space—and to the grim facts he must soon again face . . .

He wanted to wash himself clean. It wouldn't be easy, for Pruett could not escape the nagging conviction that he had prostituted the miracle of flight and the wonder of wings. He didn't want to kill but he had killed. Once in the grip of the high and mortal combat of jet against jet, he acted not as a man or as a pilot, but as a disembodied killer. There wasn't any choice. He was a fighter pilot; in the air, behind his controls, such a man must dip into the instinct of the killer or he will not survive.

Pruett and flight were as one. It wasn't so much that he "loved flying," as so many carelessly spilled the expression in their conversation. His was a kinship with the sky, he would not bother to study his feelings. He accepted them; flying was as essential to his life as eating or breathing and he never questioned the matter.

Not even the deaths of enemy pilots reached him; not the bloody froth he witnessed when his shells slammed into a cockpit, or the pilot who ejected from his MiG—and slammed into the sharp wing of another MiG directly behind him. It hadn't been a pleasant sight as the body ripped into pieces and a thin spray of pink appeared for a moment with the spinning chunks of what had an instant before been a man.

Such things were—well, Pruett didn't know what they were. He did, know, however, that in the high arena, they

met as gladiators once might have faced each other. It was man against man, skill pitted against skill, and it could become acceptable because despite the momentary differences in the battles, the odds averaged out pretty much the same. You fought a man, and if he couldn't hack it, that was the end of that scene.

No, the fights in the cold and clean edge of the stratosphere he could accept. What ground deep into his mind was another incident, only one out of the entire time he fought in the Vietnamese war, and it was this he tried to wash off his body and out of his soul.

Pruett had finished his patrols in the F-104 and volunteered to fly a second hundred missions, these in ground support flights. He flew the huge F-105 Thunderchief—called the Thud by its pilots. There came the mission when, going in to support an isolated American force, they encountered one of the rarer sights of the war. Along a road cutting between rice paddies was a heavy force of Viet Cong. The VC were mixed in with trucks and men with heavy weapons. And they were out to chop the American group into little pieces. The Thuds answered the call.

They came in low and fast, armed to the teeth with an infernal 20-mm cannon, the rotating barrel weapon that fired nearly six thousand rounds a minute; they had loads of bombs and they had rockets as well. They massacred the Viet Cong. The Thuds swept back and forth, each fighter hosing its terrible stream of rockets and cannon shells into the writhing, screaming enemy. They had virtually no cover, they couldn't melt into the jungle. Pruett estimated their number at seven hundred to a thousand and almost all of them met their ancestors in the few minutes of the carnage. The ground and the water of the rice paddies ran heavily with red; bodies and pieces of bodies sprawled in every direction.

Pruett on his last run came in low, slowing the Thud as much as he could, walking the rudder gently from side to side, using that terrible cannon as a scythe that slashed the ground and everything in its path. Another Thud was before him, giving the trucks a final going over. Apparently the other man hit an ammo truck because a dazzling ball of fire mushroomed upward, hurling slivers of truck and a dozen bodies into the air.

One of those bodies smashed against the gaping side air intake of Pruett's F-105. The Thud jerked madly. Pruett simultaneously hauled back on the stick and rammed the throttle

to full military power, the afterburner howling explosively behind him. The Thud shook off the effects of the blow and arrowed skyward—as its pilot stared at the angry red splotches and little pieces of flesh plastered against his front windscreen.

All the way home he tried to shut out the sight, and failed. He nearly wrecked the '105 as he screeched to a landing. All he wanted was to get away from that airplane. When he parked the fighter and slid back the canopy, lifting it above him and letting the outside air wash across him, several small pieces of what had been a human being fell against his clothes. An icy shudder swept through him. He dropped to the ground, his stomach quivering.

"Hey, Captain! How the hell did you manage to get this bird home in one piece?" It was his line chief, who was busy working on something that had jammed the intake.

Pruett walked around the nose just as the sergeant tugged hard, and stumbled backward. He crashed against the pilot, his hands gripping the severed remains of a foot. Pruett turned white. Behind the next airplane he was violently, wretchedly sick.

He flew ten more missions and then he had his two hundred. Every time during those last ten when he eased the fighter from the ground he uttered a silent prayer that there wouldn't be any more missions like *that* one. He had some skirmishes in the air on the way to attack ground targets and he was almost grateful to the MiG pilots who forced him to jettison his ordnance and slug it out. He punctured a few wings but scored no more kills and didn't give a damn. When they took him off combat status he was drunk for two days.

It seemed to wash some of the . . . he didn't know, but he couldn't rid himself of the feeling that he was tainted. For two days and nights he didn't have to think and he lay in his room, Celia in the back of his thoughts, secure in the all-pervading alcoholic mists. No one bothered him.

Then he couldn't take it any more. He needed his wife. He left the Far East in the belly of a huge jet transport, trying to sleep. He didn't do very well. Once again he felt that strange and disquieting sense of not-belonging; he would never make a good passenger. He was too eager to have his own hands on the controls.

Celia met him in San Francisco. Even the children would have to wait out his final cleansing. It took three weeks.

Pruett came home into a new world. He rushed headlong into demands of his mind and body that, only a few short years before, he would have considered impossibly beyond his capabilities. The bloodletting of Vietnam had had an effect upon him even he could not realize, of which he knew little or nothing. The eager fighter pilot, the hawk so swift of wing and temperament, had evolved. Pruett was unaware that he had returned from Vietnam almost as a new man, with a maturity which, had it been described to him, he would have vehemently denied and rejected.

He received assignment to one of the most coveted installations in the Air Force—the sprawling research center of Edwards Air Force Base in California. Here was the home of the Air Force Flight Test Center, testing bed of exotic aerodynamic shapes by Air Force, Navy, NASA and industrial test pilots, and the gateway to dazzling new worlds of flight, and what lay beyond even flight itself—the awesome reach into vacuum, into space.

Pruett was mildly—and pleasantly—surprised to see that he would have a friend with him at the California center. It was Ted Dougherty, a dark-haired, dark-complexioned pilot with a commanding demeanor. They met unexpectedly on the air shuttle from Los Angeles to Edwards and were delighted to learn of their similar assignments. They'd flown several missions together in Vietnam, tangling with MiG's, and Pruett's opinion of Dougherty as a fighting man and skilled flier would have given immense pleasure to the dark-haired captain.

Dougherty had been the son of a farmer and he was a farmer still when he started flying from the back pasture of their sprawling acreage in Ohio. Dougherty's father was still inflamed with the spirit of being a World War II ace; he had never given a damn for regulations when he flew Thunderbolts in Europe against the best of the Luftwaffe, and he was as tough as that famed old fighter plane. He cared even less for regulations when his son Ted was growing into long pants. The father bought a near-wreck of an old Fleet biplane, patched it up himself, and ran it with the same cheap gasoline he poured into his tractor. It was wild flying, the regulations were ignored, and if the boy didn't fly as his martinet old man told him to fly, he could expect to get the hell whopped out of him that same day.

"My old man had the strongest right arm you ever saw," Dougherty explained to Pruett. His face split into a grin.

"You got whopped a few times by Pop, and I tell you, mister, you flew that airplane like an angel. *And* by the numbers," he laughed.

Pruett had taken to Dougherty immediately, and the two at once became fast friends. Now their mutual skills and desires had made their paths cross once more—and to an extent in the future of which neither could have conceived.

They came to Edwards with their imagination afire but each with the status of student. The category afforded each man deep pride, for the small group of fifteen men that made up the student body of the Experimental Flight Test Pilot School were considered the most skilled, talented, knowledgeable, and promising young pilots in the Air Force. Each school term lasted for six months, and they proved to be the most grueling, demanding, exhausting months he'd ever spent in his life.

From the start, he knew beyond question that this constituted one of the major pivots of his life. Pruett could already look back upon the accumulating years, and slice those years into identifiable segments. It had taken him a long time to understand that becoming a pilot, even a fighter pilot, had not been enough to separate him from the great body of men who took to the air. It disturbed his pride, but there *were*, he admitted ruefully, a distressing number of veteran military pilots around. But those brief months with Ed Lyons, and the manner in which the man in his wisdom had reshaped him and created a new Pruett, could easily be recognized as critical for what the future man—Pruett—would be. Vindication had come in telling fashion in the thin cold air high over Asia.

The second time he realized he had stepped irrevocably through another door came when he walked down the hallway of the main entrance to the test pilot school. He moved slowly between rows of pictures of the experimental craft that had sundered the barriers to new flight regimes. He scanned the pictures, and saw in those brief seconds the growing wave of a new world. Ths intensive tests of the recent decade had been, literally, the roaring wave that men were riding, eager to press home the advantages they had ripped across the shores of the newest—vertical—frontiers.

Man had ridden giants of fire beyond the atmosphere and to the men who skimmed the upper atmosphere the machines in which they sundered the new horizons were already legendary. Mercury, Gemini, Vostok, Voskhod were the first.

The X-15, right here from Edwards, had already pierced space. Apollo was on the way and so was Soyuz.

But the dangerous flying was *here.*

At the end of the hallway, almost as if it were waiting at the edge of the rows of pictures, a sign had been hammered high above the floor, nailed solidly into the panels of knotty pine. It did not use, nor did it need, many words to tell of a vast and stirring adventure. The sign said, simply:

"Through these halls walk the world's best pilots and crews."

Pruett knew the meaning behind the words. They were more than a tribute to those who had hurdled the barriers and sometimes had smashed them down with brute force. They were also a remembrance. That the latter was starkly true, Pruett reaffirmed to himself when he walked through the streets of the test center.

Edwards Air Force Base . . . he stood at a corner, and the name came swimming up through his memory from years past. His full name was Glen W. Edwards, and he was a captain, and he had been at the controls of an incredible bat-shaped wing, a monster that was a wing *only.* Pruett remembered the giant, the huge wing-shape without body, nothing but that wing sliding eerily through the sky. But in June, 1948, as happens in the business of poking and prodding into unknown flight regimes, the monster took Glen Edwards to his death. And ever since, the sprawling gateway to the future had been known by the name of that young captain.

As he walked slowly, Pruett looked at the street signs. He read the names, and some of these, too, drifted from obscurity to recognition. Wolfe, Forbes, Popson, Gregorious, Seller, Payne, Bailey, Sparks, Methusa, Mortland, Lathrop—and many, many more.

And every one of them had died here—here, at this base, or not so far out beyond the edge of the great concrete runways.

Out there—like the surface of another planet. Over all, in the far distance, brooded the naked hump of Soledad, the Lonely Mountain. It looked down blindly on the plateau that rested a half mile above sea level, the plateau of the Mojave Desert they called Rogers Dry Lake. Here was the greatest landing field in the world, absolutely flat, stone-hard, baked by a sun that snarled in heat against the flattened earth.

Pruett gazed upon the ridges and the stark peaks of the mountains he would come to recognize almost instantly from

the air. The Shadow Mountains, and then the San Gabriel and the San Bernardino Ranges—a strange world within a world, a monotony of flat, almost completely sterile nothingness. Yet he would come to learn that even here, in the midst of savage conditions, life could struggle. Hugging the sand were sagebrush in coats of grayish-green; looming upward were the uncaring and distorted forms of the Joshua trees. They were the giants of the Mojave, giants thirty feet tall, defying all the odds of survival.

When the wind came screaming down the mountains, it lashed the desert and blew enormous clouds of swirling dust and sand into the air. Clumps of tumbleweed raced ahead of the blinding sand, like animals in terror fleeing a sea of fire. Sometimes their flight was arrested by the treacherous needles of the crooked cactus, and there ensued a grotesque scene of the tumbleweed struggling desperately with its strength of wind to escape before the wall of roaring sand engulfed and devoured it.

There were creatures of the sky that cast their shadows across the Mojave and rippled over the concrete runway and the structures that loomed up from the edge of the base. Creatures that cried out from steel-ringed throats and spat long streamers of flame studded with the diamonds of shock waves, that hurled thunderbolts down through the skies to crash against the ground. Creatures with razor wings and stub wings and without wings, flung through the heavens so swiftly as to make a mockery of the sound pursuing them, hammering the ground with the concussion waves of supersonic booms when the originator was already out of sight.

Pruett stood one night on the flight line as a shadowy form at the end of the runway gathered strength into its steel-hard body. The lurking giant hissed powerfully, and then—as a man moved a shaped handle forward—began to moan. A moan that grew in volume, expanding hollowly into an impossible roar as the fires within its long and deep gut burned brighter and more angrily. And then the form began to rush along the concrete expanse, still only a blur, but accelerating with breathless speed. An explosion shook the flight line as the man encased within the giant moved his throttles into afterburner and the flames shrieked loudly. Ths creature sped past him, shaking his body with the terrible sound. A long double streamer of violet fire, surrounding cores of blinding, thin flame, beat at the air behind the giant. Then the impossibly tiny wings clutched at the air, the giant shook off its

chains of gravity. The plumes of violet fire sped straight back from the exploding orifices, and bent as they met concrete. Flame bending cleanly, sharply, impossibly, a right angle of fire. It vanished as the giant screamed its freedom in a final overpowering cry of triumphal thunder. The sound splashed hotly across the concrete and rushed far out across the desert, finally to whimper itself out of existence in the twisting ravines and canyons.

A sense of wonder filled Pruett as he lifted his gaze to the heavens. The fire that sent the giant hurtling through the night air was now a dwindling pinpoint of orange flame. No longer did it rush through the air; it drifted upward. The whisper of its passage sank slowly earthward as Pruett studied the firmament revealed in the cold clarity of the desert night. And it seemed that the pinpoint of orange flame had abandoned the earth and was drifting among the stars.

There was precious little time for such scenes, or for his reflections as to where they might lead. He was a student once again, and in the period of six months allotted to his class, he and the fourteen other neophyte test pilots would equal two years of intensive, advanced studies. A full colonel commanded the school, and the instructors were five majors. Each instructor years before had earned his master's degree in aeronautical engineering. Each was a veteran test pilot. It did not escape their attention that the new student, Pruett, also had earned his master's, although no one commented directly to the newcomer.

Major Paul A. DeGroff initiated the class. DeGroff didn't bear the faintest resemblance to a man with a master's degree. He was unbelievably wide across the shoulders, a stocky, lumbering bear of a man, whose appearance was helped not at all by an angry scar that ran from behind his right ear to the side of his mouth. Pruett learned (not from DeGroff) that he was the pilot of a B-29 shot down over Japan during the great fire raids of World War II, and after landing in his parachute outside Nagoya, had been set upon while still tangled in his chute, by a berserk Japanese armed with a bayonet. The maddened Japanese caught DeGroff unawares and came close to fulfilling his wish to slice the American's head into small pieces. His face laid open, blood spurting, DeGroff emptied his .45 into the Japanese, killing him on the spot, tried to club another Japanese with the empty gun, and fell unconscious. DeGroff remembered nothing until he awoke in a prisoner-of-war camp, attended by an American doctor.

The war ended four days later and DeGroff survived because he was flown to a hospital on Saipan.

DeGroff jarred Pruett's sense of proportion. Only a man of towering strength and indomitable will could have emerged from that horrifying experience, could have endured five major operations on his face, earned his master's degree, and returned to rank among the most capable pilots in the world. Pruett resolved to pay the closest attention to the grizzly-like major.

DeGroff sat on the edge of his desk, lit a cigarette slowly, and introduced himself. Then he got down to business.

"Within the next six months, gentlemen, you are going to absorb the equal of two years of intensive and advanced studies. You are going to perform one step short of being supermen. I'm sure you already know that or you wouldn't be here. I want to focus it once again in your minds. You will be required to have a thorough knowledge of the theory of flight, of aeronautical mechanics and aerodynamics, plane geometry, algebra, differential calculus, meteorology, astronomy, every type of navigation you have ever heard of—and then some we don't have names for yet. You will span the full gamut from aeronautics to astronomy and you will learn, intimately, the function and operation of piston, jet, turboprop, ramjet, turboramjet, and a variety of rocket motors and engines. You will become expert in the fields of electronics, metallurgy, celestial mechanics, aerospace medicine, and—well, in short, anything and everything that may remotely affect the work we do here at Edwards and other test centers around the country."

DeGroff stubbed out his cigarette butt. "You will also bone up on astronautics. You will learn that inside and outside. Some people call it astronautics, or space flight, or aerospace science. That don't make a rat's ass, to use one of our finer expressions." He grinned. "The space program, as you know, is carried out by NASA on one hand and the Air Force on the other. The Navy has joined with NASA, it seems, but maybe that's because we haven't any Navy pilots in the Manned Orbiting Laboratory." The grin went away. "Just keep one thing in mind, gentlemen. Every astronaut in Project Mercury and Project Gemini, and every Air Force space pilot in the MOL program, was a test pilot. Virtually every one of them went through this school. There are some types in Apollo who come from other corners of the world,

but the people who came through *here* are the ones who take them up and bring them home again."

He rose to his feet. "If it will make you happier, gentlemen," he said, "this is only the beginning." A groan came from one of the desks. DeGroff smiled. "The classrooms will constitute a lesser part of the time you spend in this school. Your real work—the *hard* work—will take place in the cockpit. I hope you enjoy your stay with us, gentlemen. You have—" he glanced at his watch, "exactly twelve minutes before your first class begins. Those twelve minutes will be the *only* relaxation you will have, I'm sure, for the next six months. So—enjoy them."

Pruett plunged into his work. He had no concern that he could meet and likely exceed any requirements made of him either in the brain department or as a pilot. He studied and flew with the assurance of the man who has already put behind him a series of acid tests of his capabilities. Yet he was surprised by the intensity of the demands placed upon himself and the other students. He came to surmise—and correctly—that they were being pushed deliberately, that each new class provided a guideline to the maximum of performance that might be extracted from any one individual.

Pruett had learned one lesson through the years that stood him well: generalize, but never dogmatize. The advanced technical courses of the school were unquestionably severe, but he knew his success in this respect lay directly in proportion to his efforts. Despite his well-meaning intentions not to anticipate his degree of success in the cockpit, he was to find that even with his already extensive experience as a pilot he had much indeed to learn.

DeGroff took him to the flight line and stopped before an F-100F, a two-seat version of a powerful, shovel-nosed brute that pilots had christened the *Lead Sled,* for it could be harshly unforgiving of pilot inexperience or overconfidence.

There was something else . . .

Pruett gestured at the Super Sabre. "We're going to train in *this* thing? This wreck?"

DeGroff looked at him with eyes of innocence. "What's wrong with it?"

"It's old," Pruett complained. "It's *ancient.* I mean, Christ, major, I've spent a lot of time in the '104 and the '105, and, for that matter, the—"

"F-4C also," DeGroff finished for him. "I know. Would you believe I have a copy of your record?"

Pruett knew he'd pulled off a no-no. DeGroff motioned for him to get aboard. Ensconced in the rear seat of the fighter, he rested on his lap a checklist so thick and heavy it startled even the most experienced pilots. Suspicion formed like a black cloud in the skull of one Captain James R. Pruett. This could not be, he warned himself, an ordinary iron bird. They had done something to this slab-sided piece of flying machinery and he was also certain it wouldn't be very pleasant. For there was no reason, none at all, to have his ass put through a wringer in the F-100F when he'd put in more than a thousand hours of flying fighters much hotter and rougher to handle.

But DeGroff was one ahead of his student. The "special" F-100F was still in its hangar and Pruett was, indeed, flying a stock, venerable, old-fashioned F-100F. It told DeGroff what he could discover only in the air; Pruett had *the* touch. DeGroff also discovered that Pruett as the student was unquestionably the master of the teacher in aerobatics. It was all DeGroff could do to keep from singing Pruett's praises aloud to the student.

DeGroff did, however, recommend to the school commandant that careful attention be paid to the progress the new pilot would exhibit. Pruett was not yet elevated to the exclusive test pilot circle, for scholastic knowledge and the master's touch in aerobatics do not necessarily a test pilot make.

But his name went out on a secret list. One copy to the Manned Orbiting Laboratory program of the Air Force, and the other to the director of astronaut selection of the National Aeronautics and Space Administration. It was a "keep your eye on this man" list.

Testing, knew the men who were shaping Jim Pruett, was also a matter of infinite patience, of extraordinary skill in flying with hairline precision in level flight, of ferreting out data on temperatures and pressures under meticulously established conditions. And there are few things more difficult in flying than *absolutely* straight and level flight over a long distance, when the air is filled with the invisible rocks and reefs of turbulence.

DeGroff unkindly put the screws on Pruett. The modern jet fighter is a massive metal animal with hydraulic sinews. At supersonic speeds it is impossible for a human being to

move the controls, the surfaces in the windstream, against the terrible airblast and shock waves inherent in such flight. So the control system is rigged with an elaborate power boost. When the pilot moves the stick, an electronic system senses the movement as a demand for energy. Immediately it adds hydraulic muscle to the control system, and the result is that the strength of a dozen men is available to move the control surfaces of the wings or the tail.

This system in turn creates its own drawbacks, especially for the pilot who has spent years learning to feel and sense instinctively the moods of his airplanes. He comes to know the whispers of external forces as turbulence slaps against his airplane. He understands what the airplane means when it trembles slightly, or "talks" to him in yet other ways. When he moves into the machine with power-boosted controls, he loses these sensory connections between his body and the airplane. The substitute is mechanical and hydraulic. In the ultimate sense such systems lack the "ass" with which to feel flight.

The pilot must adapt to the new system and he can do this only by modifying his own instincts. There are many pilots who do not care a fig for the change, but it is inevitable and it is mastered easily enough.

Except when the instructor is DeGroff, who intends to put a man of great promise through the wringer. DeGroff ordered his "special" F-100F rolled out. The control system of the "ancient Lead Sled" had been modified. It lacked normal power boost. Instead, it had the kind of control sensitivity one fears in a bottle of nitroglycerine bouncing about the floorboards of a truck speeding along a badly rutted road. That F-100F was a bitch coming and going. It was so sensitive and so responsive to its controls that the barest pressure of a finger brought on an instant and astonishing reaction from the airplane. DeGroff could do extensive aerobatics in the modified Lead Sled with two fingers held lightly at the stick.

Pruett couldn't keep the airplane flying straight and level. The Sled shied skittishly the instant his hand touched the stick. At first he was astonished. After attempting to hold level flight, while the airplane wallowed its wings from side to side despite his best efforts, he grew both bewildered and angry. He flew directly on course but he could *not* keep the wings level. As the airplane started rolling to the left he

brought corrective action to the right. But no matter what he did his flight resembled a boat rolling slowly from side to side.

His anger grew—more at himself than at the mindless machine—and threatened to destroy his attempts to control when there flashed in his mind one biting word: *"Hotshot."* Pruett chuckled and relaxed his grip. He brought up one knee close to the stick and carefully placed his right elbow on the knee. Then, extending his thumb and index finger, he tried not to touch, but to caress the baffling control stick. The rolling motion eased immediately and within several minutes disappeared altogether.

DeGroff watched the proceedings through two mirrors placed in the front seat. He anticipated the rising frustration of the student pilot, and was pleased that the natural reaction to anger should be eliminated so quickly. None of his pleasure showed.

"Captain Pruett!"

"Sir?"

"Captain, that is a hell of a way to fly an airplane. Would you mind telling me what those physical contortions of yours are supposed to mean? Are you bringing something new and illuminating to the world of test flying? Perhaps you have some revolutionary method to replace our shopworn and antiquated procedures!"

"No, sir."

"No, sir, *what?*"

"Major, if I don't keep my knee just so, and my fingers just so, I can't keep this souped-up piece of metal from rolling like a drunken sailor."

"You can't?"

"No, sir."

"Well, Captain, you're an honest beggar, anyway. What's wrong with this sled?"

"Nothing wrong—but obviously you've gimmicked up the boost system so this thing thinks almost faster than I do about what I want to—"

"Give me a flick roll to the left, Pruett."

Sure . . .

The fighter whipped hard over to the left, a spinning blur as the wings flashed around. Pruett worked the stick and rudder to snap out quickly and exactly on point, level with the horizon, but the supersensitive airplane wouldn't stay where

he wanted it. It rocked badly and went through several roller-coaster motions before Pruett could calm the beast.

"Pretty good for a novice, Pruett."

"What the hell was—sir—what the hell was good about *that!*"

DeGroff laughed. "The last guy we had in that seat, who tried a flick roll the first time, managed to settle down after he'd rolled around four times. Okay. I've got it."

Pruett rubbed his aching arm; the task of holding the stick with the lightest touch possible was proving to be more demanding than strenuous aerobatics. He had unknowingly created a deep impression on DeGroff, for the instructor, despite his hopes, had not expected Pruett to adjust so quickly to the oversensitive control system.

And so began the extensive program of shaping Pruett into the skilled and brilliant test pilot he would become, the program that would fling open the doors for him to flight at speeds and heights beyond the remotest reach of even the most advanced machines at the test center. He roared into the cool desert air almost every morning at dawn, DeGroff pushing, demanding, and privately exulting in the progress of the student. He learned to handle the wickedly sensitive training machines with the same ingrained skill with which a bird adjusts its feathers in flight. He sat through hours of coldly analytical studies of his performance, as he—and DeGroff—examined on a large screen slow-motion films of his flight instruments during his time in the air. Frame by frame the camera revealed the hairline errors in a performance which, virtually anywhere else in the world, would have been regarded as outstanding. But here, at the great flight test center, these minute errors were no more than an added spur to go up, again and again and again, until not even a shadow of the hairline of error remained.

He flew fighters and bombers, trainers and transports, liaison airplanes and a weird assortment of experimental aircraft. He flew them to requirements and tolerances he would have said were impossible only a few short months before. He walked in blistering heat to his airplanes while burdened with a heavy pressure suit and helmet, chafing from the bladdered undergarments of a g-suit that would squeeze and grasp his legs, thighs and stomach while he wracked the airplanes around in turns and other maneuvers, and his body weight

shot from his normal hundred and eighty pounds to more than fifteen hundred pounds.

He learned to fly an enormous roller coaster in the sky with the F-100F and a dozen other machines, some fighters, the others huge transports. But it was that supersensitive Lead Sled that walked the thin hairline of tumbling flight under such maneuvers. He learned to slide over into a dive at an exact angle and with an exact speed, and to pull up at a precise point in the sky, with exactly the right level of centrifugal force, to pull up at a specific angle, and then carefully to push the stick forward and to hold it—ahhh, *just so.*

And when he flew the roller coaster, which is how the pilots described the precision parabolic arcs of their fighters, the airplanes soared up and over in a huge curve through the sky, and for as long as sixty seconds, they were completely weightless. For a full minute the fighters hung in a perfect balance between gravity and centrifugal force, and the eerie world of zero gravity brought dust and dirt floating up from the floor and beneath the seats, and the pressurization and cooling system of the fighter went ape and spewed snowflakes beneath the rounded plexiglas.

In the back seat of the machine, DeGroff floated freely between his seat and the rounded clear canopy, and when Pruett was really good and the parabola was perfect, the instructor would reward the student with a rasping rendition of "Come Josephine, In My Weightless Machine."

Then the six months were gone. The fifteen students had been reborn with skills and capabilities which were the respectful envy of all pilots who truly understood the obstacles these men had overcome. Of the graduating class, thirteen men were assigned to test centers throughout the United States. No better accolade could have been bestowed on Pruett than his own assignment. He would be a test pilot, here—at Edwards.

There came an added bonus. "How would you like to work on some NASA programs while you're here?" DeGroff asked.

Pruett raised an eyebrow.

"X-15, for one. Also, we've got you slated for RS-71 flights —*after* you learn how to fly the '104, that is. We—"

"*Learn* to fly the '104?" Pruett barked. "Ain't you forgetting what—"

"You know better than that," DeGroff cut in. "I know all about those ham-footed MiG pilots you clobbered. I'm talk-

ing about *our* '104. We've, ah, sort of made a few changes to the little iron bird."

Pruett grinned. "I'll bet."

"There's some lifting body flights . . ." DeGroff went on to describe a series of experimental programs designed to water the mouth of any test pilot. When DeGroff finished, Pruett had a question of his own.

"I thought this NASA kick was all civilian," he said. "From what I hear they're the good people and us guys in uniform are the baddies. You know, space for peace and all that crap."

"Exactly what it is," DeGroff nodded. "So much crap. That's political. We all play the same game only we use different names. This ain't a contest, Jim. We're on the same ball team."

"Good to hear it said out loud," Pruett grunted. "When do I go to work?"

"Well, you do need a break," DeGroff admitted. He glanced at his watch. "It's almost two now. Why don't you take the rest of the day off and be here tomorrow morning at six. That's A.M., friend."

Pruett disliked breaking up with Ted Dougherty, but the dark-haired pilot had proven himself just one step short of a genius in the technique of lobbing high explosives from low-flying fighters into a variety of difficult targets. The Air Force assigned Dougherty to weapons development at Eglin Air Force Base along the Florida Gulf Coast, where he would wage a hellish war—without someone shooting back at him—with hundreds of tons of explosives, perfecting new weapons and combat techniques.

"We're bound to cross paths again, Jim," Dougherty said as the two friends parted after their graduation. "I don't know if you're going to be like me, a supersonic hatchet man on the deck, but—well—hell, I'll be seeing you." He threw Pruett a departing salute and climbed into the cockpit of a hulking Phantom. Minutes later Pruett watched the machine dwindle to a dot and disappear.

Neither of them could know how true a prophet Dougherty was to prove.

Chapter VI

At several different research and development centers throughout the United States, small bands of men continued their nonstop, sleepless, round-the-clock labors to hunt down, identify and solve the same problem that eluded them all. At one of these centers an entire Apollo spacecraft, identical on a one-to-one basis not only with the propulsion system of the Apollo service module but with the entire spacecraft, had been assembled, and placed within the yawning confines of a thick-walled vacuum chamber. For hours, since the doors were sealed and the air within evacuated to simulate as closely as possible the conditions that existed far above the earth, the technicians and engineers had been engaged in their maddening search for the elusive needle in the technical haystack of the Apollo. From nose to end the vehicle was thirty-four feet long, the exact length of Ironman One. The cone-shaped command module, twelve feet high by twelve feet ten inches in diameter, had been mated snugly with the service module. This was done in order to duplicate the many fittings and connections between the two systems. All told, the two spacecraft weighed nearly sixty-eight thousand pounds. In an attempt to approximate even further the lethal situation faced by Astronauts Pruett, Lloyd and Stone, three technicians, in pressure suits, were sealed within the command module. They went through every step carried out by the astronauts even then high above them. Step by step they went down the procedures manuals, along the checklists, re-

peating to the last detail what had been carried out aboard Ironman One.

Every element of the service module was wired and hooked up to take the pulse, temperature, respiration, and other electronic and mechanical equivalents of a machine that must produce a robot form of life. By this meticulous procedure the fault, when discovered, could be immediately isolated, and the cure for the mechanical ailment applied hopefully swift.

The service module proper was a cylinder twenty-two feet long by twelve feet ten inches in diameter. At launch many months ago it had weighed more than fifty-five thousand pounds. Within their special chamber, the astronauts carrying out the roles of Pruett, Lloyd and Stone had already fired the main engine the exact number of seconds imposed upon Ironman One, and now they were down to the same fuel weight of the spacecraft in orbit. Aluminum honeycomb panels one inch thick formed the outer skin of the service module, and milled aluminum radial beams separated the interior into six sections containing the service propulsion system and reaction control fuel-oxidizer tankage, fuel cells and onboard consumables.

It was the SPS—the Service Propulsion System—that defied all attempts to ferret out its failure. The SPS provided thrust for major velocity changes for Ironman. Right now its failure to carry out its deorbit burn had created the emergency these men were attempting to solve. The main engine was a gimbal-mounted, 20,500-pound thrust hypergolic power plant that burned nitrogen tetroxide oxidizer with a fifty-fifty mixture of unsymmetrical dimethyl hydrazine and hydrazine fuel. The engine system tankage was packaged neatly within the cylindrical shape of the service module.

The system had never failed. The SPS responded to automatic firing commands from the guidance and navigations system, or to manual commands from the crew. The engine provided a constant thrust rate of 20,500 pounds as rated in vacuum, and its stabilization and control system gimbaled the engine as necessary to fire through the spacecraft center of gravity.

In a total of sixteen manned missions, including nine flights in orbit around the moon, the engine had never even faltered.

Now it had failed. And these were the men best equipped to find out why, and to come up with the answer that would

save the lives of three other men. But time was running out on them.

The basic elements of the SPS were simplicity worked out to the utmost degree of reliability. The entire engine system had precisely ninety-three moving parts. Originally that figure had been just over a hundred but experience reduced the number of things that had to move one way or another. The engine system had been built for absolute reliability in that it had duplicate sets of valves, plumbing lines and electrical controls. Except for the flaring combustion chamber, every criticial part had a backup system. The fluids from which Ironman One derived its blazing flame were self-igniting. Hypergolics, as they were known, burned spontaneously upon contact. Thus there could be no failure of the ignition system, for there was none.

The service module also featured a Reaction Control System which was fed the same fuels as the main engine. The RCS controls had four identical quads of four 100-pound thrust engines mounted near the top of the service module, ninety degrees apart to provide redundant spacecraft attitude control through cross-coupling logic inputs from the Stabilization and Guidance Systems. Helium pressure fed the hypergolic fuel from its tanks both to the reaction controls and the main engine.

Special scrutiny was given the Electrical Power System, which consisted of three, 31-cell Bacon-type hydrogen-oxygen fuel cell power plants within the service module. These supplied 28-volt DC power; there were also three 28-volt DC zinc-silver oxide main storage batteries in the command module lower equipment bay, two pyrotechnic batteries in the command module lower equipment bay, and three 115-200-volt 400-cycle three-phase AC inverters powered by the main 28-volt DC bus. The inverters were also located in the lower equipment bay. Supercritical cryogenic hydrogen and oxygen reacted in the fuel cell stacks to provide electrical power, potable water and heat. In an emergency the command module main batteries could be switched to fire pyrotechnics. A battery charger built the batteries to full strength as this was required.

It was a magnificent system—except that it wouldn't work...

There was so little time! The odds were increasingly against finding the fault. The basic design itself was so excellent, its manufacture so impeccable, its past performance so

flawless, that either the trouble should have been immediately apparent, or the chances of its discovery lessened with every passing hour. The technicians and the engineers in one test center followed every procedure meticulously. Others threw away their elaborate checklists that dictated the slow and cautious ritual of exhaustive checkout. They must try to cut corners, poke and prod and stab and delve, squeeze and test, pinch and measure, all without wasting a single minute.

In the vacuum chamber, the men outside and the men within the command module felt gloomier by the minute. They had reached the point of automatic firing of the powerful SPS engine that had been attempted by the crew of Ironman One.

The engine fired.

They set up the manual mode and tried again to duplicate the failure.

The engine screamed with thrusting flame.

They introduced artificial problems, deliberate obstacles, trying to duplicate anything that might have happened within that magnificent coffin-to-be plunging around the world.

In the control room the telephone rang.

"This is Keith. Have you got anything yet?"

"We're trying. We're now running through cross-possibilities with different systems. We—"

"What in the name of hell is taking you so long?"

"You know damned well what's taking us so long! No one has ever pulled a test run like this before, trying to make something fail. We haven't got any guidelines, any experience with this sort of thing. For Christ's sake, man, we need time to do this!"

"We haven't got any time. There isn't any time. We don't even have minutes to spare. How much longer?"

"If you'll get off this goddamn phone and let us get on with it, we'd get this thing done a whole lot sooner, and maybe we'd learn something. Now, stay the hell out of our hair. We'll call you the moment we have something to say."

The telephone slammed own onto the receiver.

Three electrical leads were severed. Interference was introduced into the connector systems. Helium pressurization was messed up. Fuel flow was made ragged.

The engine howled with power.

At Houston Flight, Charles Keith studied the large wall clock in the master room. In twenty minutes or so he would

be talking to Pruett as Ironman rushed up within direct range.

He didn't have anything to say.

The years that followed Pruett's initiation into the world of test flying slowly assumed a pattern. At first, engrossed as he was in the intense activity that became his daily life, the evolution escaped him. But as the months wore on and he extended his now highly professional skill not only as a pilot but as an engineer and, in his own right, an aeronautical scientist, he came to recognize that he was of the material that fitted perfectly the needs of the country for the men who would transform space into a permanent domain. Pruett did much of his flying at the sprawling flight test center in California, but his work took him all over the United States to such locations as Wright-Patterson Air Force Base in Ohio, the Kennedy Space Center in Florida, the Manned Spacecraft Center and the School of Aerospace Medicine in Texas.

The men who were pushing the new Apollo beyond the planet had neither the time nor the facilities to experiment with the prosaic items that filled their spacecraft. Pruett flew fighters and large transports repeatedly through the high parabolic arcs that created weightlessness for limited time, until he became so adept at the maneuver, keeping the entry and exit from behind overly punishing, that he found himself in demand by the scientists developing equipment and materials for space flight. Behind him, men in a variety of aircraft floated freely and weightlessly while they operated control boards and performed a bewildering variety of tests. Pruett learned to expect globules of water and other assorted liquids, bread crumbs, flaked meat, processed fruits and vegetables, and even crumbling cookies as the scientists experimented with the different foods that would be sent to such unexpected designations as the surface of the moon. He learned not to frown too strongly when yowling kittens spun helplessly in the temporary zero-g fields, but he was wholly unprepared for a bright yellow canary that darted from the fuselage of a C-135 transport into the cockpit and grabbed wildly for his nose and sunglasses.

Perhaps the most exhilarating of all the flight programs was the "special beast" to which DeGroff had referred—the F-104 that was intended to "separate the men from the boys." Pruett grinned like a hungry kid turned loose in an

apple orchard. The airplane looked the same as an ordinary Starfighter. Then Pruett looked a bit closer, and when he walked around the machine to view it in profile, he saw the single biggest change. A cylindrical housing bulged beneath the aft fuselage and at the far end of that housing there projected a small rocket chamber. This was the kick in the slats that would take the howling beast to a height of more than twenty miles, where the machine would be moving above more than ninety-nine per cent of the atmosphere of the planet. Literally, man and machine were in space. The normal controls, the surfaces that moved within the airstream, were useless. The pilot could, and Pruett often did, kick rudder, elevators and ailerons all over the place without the slightest effect; there simply wasn't enough air at that altitude and speed to matter. So the "special beast" had the same kind of reaction controls fitted to spacecraft, small but powerful thrusters that controlled pitch, yaw and roll precisely as they did for a machine in orbit. *Only*—and it was a whopping great only—if you screwed up in a spacecraft with your attitude, you could take a deep breath and try it again. And again, and again.

Not in that '104, you couldn't. The ride to the edge of space was hairy and exhilarating and Pruett never got enough of it. He took the Beast on jet power to just above forty thousand feet, set up his speed run "just so," brought up the nose when he was supersonic and rushing higher, and then kicked in the rocket engine. The kick slammed him back into his seat and the Beast trembled as it accelerated swiftly. The screaming fire behind him lasted only briefly, but with the speed already gained from the powerful jet, it was enough to send the '104 ripping upward along a steep parabola. The approach into the parabolic arc had to be perfect. Had to be, or the pilot found himself on the short end of the stick. The rocket engine howled until it spat away the last drop of fuel and crashed into silence. Moments later the jet engine followed suit since it had ascended to a height where there wasn't sufficient air to sustain its fires of combustion as an air-breathing system. At this moment it was sheer, heady momentum that carried the Beast skyward. It had to be along exactly the correct arc or else the flight failed. If the arc were too low the airplane quickly heated up to dangerous limits, and even a mistake of a few degrees deflection could mean exceeding the thermal limitations and overstressing, by heat and shock wave, the canopy and certain structural elements of the

'104. *That* meant the bird coming unglued at a speed and under flight conditions where the unglueing was quite likely to be catastrophic.

If the arc were along the other end of the danger scale, it meant the '104 would hurtle skyward at too steep an angle, like a rocket fired nearly along the vertical. Then it would soar to its maximum height, hang suspended at the edge of space, and begin a sickening plunge downward. Sickening, because the angle of descent would be just as steep as the incorrect angle of ascent, and the pilot would come hell-bent for leather back into the atmosphere at too great a speed and much too rapidly. Excessive heating, deceleration and g-loads could make hash of his fine machine just as effectively as tearing with excess speed through the thicker, lower atmosphere.

The answer, of course, lay in threading a path of flight in between these two extremes. Then the pilot fell heir to the exhilaration of flight, a sense of lightness and floating as his craft ripped away from resisting atmosphere. Sound fell away; with his heavy pressure helmet, the only noise the pilot would hear would be the sound of his own breathing. And the radio of course, that tenuous thread of invisible waves with the ground so far below. The airplane soared in a magnificent arc, the sun brightening until it lashed savagely at man and machine, and the man thanked his gods for the thick helmet visor that reduced the solar glare to bearable proportion. Quickly the regular controls became useless.

From this point on Pruett might have been flying a hundred miles above the earth instead of only twenty. The small thrusters functioned exactly as they did within a spacecraft, the bursts of energy controlling the attitude of the machine. Pruett looked up to see the sun as a bright button, its eye-searing strength sapped by the thick, dark visor. During these periods of soaring up and over through the great arc he was weightless for several minutes. It was the type of flying in which he delighted.

The plunge back into thickening air demanded extraordinary skill and precise timing. He had to maintain an attitude that permitted the Beast to sustain its arrow stability as the air increased is effect with frightening speed. No blunt heat shield or parachute could be relied upon to protect him in this maneuver. It was a case of being right the first time, or in deep trouble.

Once the Beast almost got away from him. So enthralled

was Pruett with the sight of the earth's curving horizon that for the moment he forgot himself. By the time he regained his senses—"that bloody sightseeing nearly killed me," he admitted later—the Beast was whipping through resisting air, but instead of the airplane being in its right attitude, it came in at a sloppy angle. The building air loads took effect and before Pruett could correct, the Beast clawed around savagely, under the control of the heavier air and its effect upon the fixed control surfaces. The reaction was so violent that Pruett blacked out from the g-forces. He came awake at an altitude of twenty thousand feet, ripping downward, the engine dead, and a chase plane pilot shouting at him through his radio. He managed an air restart and landed, shaken, at Edwards. Never again did he commit such an error.

A week later another pilot let the Beast get away from him for several seconds too long. That was all it took. Pruett was one of the pilots who watched the '104 come down in a deadly flat spin. For some reason they would never know, the pilot failed to get out—or was trying to save the ship until the last possible moment—and the Beast smashed into the desert, instantly killing its pilot.

Pruett graduated to the long, wicked-looking X-15, the Black Monster pushed by an engine of well over fifty thousand pounds thrust. His first look at the long, black body and the stub wings was enough for Pruett. He wanted that bird and he wanted it badly. Pruett went through X-15 training, learning every element of the machine there was to know, spending hours talking with pilots who'd already flown the monster, watching film after film taken during the test flights. He watched with consuming interest as technicians chained the X-15 to steel shackles in concrete, and then fired the howling volcano in the aft section of the half airplane, half spaceship. He looked with undisguised anticipation at the huge B-52 bomber that was the aerial drop platform for the X-15, studied every move as the long black shape was fitted to an underwind pylon.

Pruett's first three flights were comparatively low, although each of them far surpassed the best he'd done with the rocket-powered F-104. He reached to a height of nearly forty miles, tearing up and away from his drop altitude of 45,000 feet, the volcano hammering him faster and higher. Then came the Big One.

The B-52 started its roll on a blisteringly hot day, the temperature 114 in the shade. Within the cramped cockpit of the

X-15, suspended beneath the wing of the huge jet bomber, Pruett was sealed within his pressure suit and free of the oppressive heat. He felt the familiar undulations of the takeoff, the great wings flexing up and down, rocking him vertically as metal twisted to meet the shock of the roll. Then the wings bent even higher as lift began to assert its force on the machine and the huge assembly thundered into the air. The gear of the bomber thumped solidly as it retracted.

During the long climb to altitude Pruett, in constant radio touch with ground controllers and observers within the B-52, as well as with the pilots of supersonic chase planes, monitored the X-15 systems for the brief moment of fiery life and then the coasting period to—literally—out of this world. At drop altitude the B-52 made a practice run along the radar-controlled "straight racetrack" before dumping Pruett in his black beast. The count went without a hitch, Pruett called off the numbers with the crew of the B-52, and then fell away. Within seconds he had the big engine burning. The thrust built swiftly and he brought up the nose exactly in accord with the flight plan, every degree of angle precisely where it belonged. Angle of climb, angle of attack of the wings, speed and angle and angle of attack, of course, all of it matching exquisitely. Then the fuel was gone and the earth was already rounding its horizon when the big engine crashed into silence.

Dirt and dust floated in the cockpit with him. This he knew from the previous flights, but never before had he experienced the tremendous sense of freedom as with almost complete silence he kept rushing up from the receding planet.

He peaked at sixty-seven miles. The space about him was completely black, the stars shining hard and bright without the familiar twinkle of lower atmosphere. He felt he could have reached out and touched the moon.

A Pegasus satellite ghosted into view, moving with deceptive speed, breaking the horizon and gleaming with a light he didn't believe possible for solar reflection of metal still far off.

That same day, with radar confirmation of his altitude, Pruett received his astronaut wings. The United States and the Soviet Union were cosigners of an international agreement specifying the altitude requirements for official space flight records. The agreement listed a space flight as beginning at a height of a hundred kilometers. Pruett, having flown to one hundred and eight, became a member of that

small and elite group of men who had reached into space on wings.

Jim Pruett flew the gamut from rapierlike machines to the grossest of ugly ducklings. He spent several months behind the controls of Lockheed's futuristic SR-71, a dull black giant with two booming jets being groomed for strategic reconnaissance missions. The X-15 was faster and he had flown higher in the special modification of the rocket-powered F-104, but no other airplane in the world could compare with the performance of the SR-71.

This was the machine in which he arrowed up to a height of eighty thousand feet and then settled down for a nonstop cruise flight of six thousand miles with a speed greater than 2,400 miles per hour.

At several times the speed of sound, just beneath the roof of the world, he felt more isolated, cut off from humanity, than he had while cresting the atmosphere in the X-15.

The most difficult machine he was to fly was the LLTV, a grotesque parody of anything that had ever left the ground. It was a stilt-legged, ugly, vicious thing of plumbing that surrounded a shrieking turbofan jet engine—pointing straight down. The jet canceled out five-sixths of the total weight of the LLTV—Lunar Landing Training Vehicle—while small rocket engines that simulated the thrusters of an LM, the lunar module for the Apollo landings on the moon, controlled the actual ascent and descent. Pruett sat within a small cab that crudely mocked the pilot's compartment of the actual lunar module, and within this terrible and noisy machine he practiced flying straight up and straight down, hovering, moving skittishly to either side or backwards. He had convinced himself that several hundred hours' flying time in a helicopter would prepare him for the ugly duckling, but concluded that *nothing* would ever prepare anybody for the thing.

On his twenty-eighth flight, at an altitude of barely two hundred feet, the jet engine quit. There was no way out, except straight up. Pruett hit the handle and punched out. A blazing rocket hurled Pruett, still within his seat, through the roof of the control cab, and lofted him to barely three hundred feet above concrete. Smaller pyrotechnics kicked him away from the seat, blasted out his parachute, and saved his life.

Test flying, concluded Pruett, left little room for a man to be bored with life.

His future came to him one night far beyond the edge of Edwards Air Force Base, across the entire span of Rogers Dry Lake, and some miles beyond, to the huge granite outcroppings and massive walls of Leuhman Ridge. Here, anchored deep within the granite, chained to the substance of the earth itself, were enormous static test stands for the rocket engine assemblies of the coming years. Leuhman Ridge itself suggested an outpost into tomorrow; some mysterious upheaval of the earth unnumbered millions of years past had thrust the rugged granite masses out of the desert to stand alone, far removed from the ranges of mountains.

The desert air, normally quiescent, was tortured shamelessly at Leuhman Ridge. From squat buildings that pockmarked the outcroppings there issued a cacophony of clanging, hammering, shrieking sounds as men operated power equipment, readied machines for tests, sucked supercold liquids from the blistering air, and performed the myriad other rites and rituals of the new technology.

One summer evening Pruett and a half dozen astronauts from NASA arrived at Leuhman Ridge for the static testing of a massive new propulsion system. It was one of the few such systems being kept under security lock and key, so powerful that not even the huge facilities of the Marshall Space Flight Center in Alabama, or others throughout the country, would handle the awesome energy. Once out of range of too many observers, the astronauts, who flew in that day from Houston in their lithe T-38 personal jets, quickly shed their assumed composure. They were as interested and as excited as if they'd designed the system themselves. That same evening Pruett could understand why.

The Saturn V booster in its first stage, the S-IC, mounted five F.1 engines, *each* capable of producing 1,580,000 pounds thrust. At liftoff from Complex 39 of the Kennedy Space Center the first stage fought earth's gravity with a combined thrust of nearly eight million pounds—more than enough to start on its way to the moon the total Saturn V weight of 6,490,000 pounds. This was enough to sling into lunar injection a payload of some fifty tons.

It wasn't enough for Tomorrow.

Enginers modified the turbopump systems of the F-1 engine and introduced a host of alternations that increased measura-

bly the total output of each engine. The thrust went from 1,580,000 per engine to just over 2,000,000 pounds thrust—a thousand tons per engine. The assembly shackled on the edge of the desert was not, however, of five engines, but of eight. A total power of 16,000,000 pounds thrust—a simultaneous push of eight thousand tons—was about to receive its first full-up, balls-out test.

Pruett glanced at the very top of the granite ridge, where an incongruous traffic light shone balefully with a single eye of amber. This signaled Condition General Amber, during which the technicians fueled the tanks for the static test. The first stage of the new booster to be tested dwarfed anything that had ever flown, including the Saturn V that had already hurled so many payloads to the moon. Pruett prepared himself for the jangling onslaughts of preliminary sounds, announced by a fire alarm bell that clanged stridently. The sound that alerted him to the closeness of the test was the shrill and mounting cry of steel-toned pipes singing in high-pitched torment as they were subjected to the 300 below zero liquid oxygen bubbling into the tanks.

One of the astronauts, speaking to himself as much as to anyone around, made a revealing comment. "We could ride that mother all the way to Mars," he breathed. He glanced at Pruett, and grinned self-consciously. "I'd give my left nut to make that trip."

And so would I, Pruett thought, and was astonished; he had never thought that seriously about leaving the earth so far behind as to reduce it to no more than a blue marble in a black sky . . .

Floodlights stripped the area naked of darkness as a siren began to scream, and the traffic light flashed from amber to red. Along with the astronauts and other observers, Pruett moved into a thick blockhouse, from where he would observe the firing though a periscope. He disdained the TV monitors, wanting to watch what happened directly and not on a flickering screen. He rested his arms on the scope handle, turning slowly to survey the entire scene.

Red lights winked along different elevations of the test stand proper, a towering assembly of metal beams that loomed against the floodlights like the hulking skeleton of a dinosaur dredged from the desert floor. Beyond, silhouetted in the light beams spraying the desert, the Joshua trees cast mile-long shadows across the naked surface. Pruett swung the scope around hurriedly when he heard the blockhouse talker

intone: "Minus sixty seconds and counting. This is a live count. On my mark—fifty seconds and counting."

Then eight bursts of pure-white smoke, one from each giant combustion chamber. The appearance of the smoke was so instantaneous, so sharp and defined, so clear it was almost as if eight powerful searchlights had snapped on to pierce velvet blackness. The smoke stood etched like eight angled pillars of white marble. But only for an instant.

Flame: pure, blinding, shocking. White streams of fire. Not red or yellow or orange. Intense, *white*. Flame that was alive, hard as steel, punctuated throughout with shock diamonds that danced and quivered in the river wombs of flame.

The blinding white subsided abruptly, and savage tongues of flame snatched from deep in Hell, intolerably red and impossibly bright, leaped into existence. In the pit far beneath the flaring combustion chambers, the flames became a *thing* writhing in senseless agony, struggling to run amuck. Pruett gasped as the scene overwhelmed him, and the earth beneath his feet, the solid granite, began to shake ever so gently. It occurred to him that he was watching an energy release so mighty that it could be compared only to the birth of a nuclear explosion. The shaking increased. Rotating steel burrs appeared suddenly within his teeth and rattled his eyes in their sockets; men in the blockhouse looked up, startled by the effect of the ultrasonic lash from the engines, the tremendously deep, sonorous rumble of thunder mixing with the higher sound. From below the flame pit great chunks of granite were shattered and flung wildly through the air, still glowing cherry-red from the caress of the flame.

A cataclysmic shriek tore the sky. It seemed impossible that it could continue, but it did, and in his mind Pruett imagined that terrible, mighty, savage flame hurling a great spacecraft away from the earth, rushing into deep space, and . . . a momentary scream stabbed into his ears as the flame died.

He didn't question the future any longer. He knew just where he was going.

Out there . . .

Chapter VII

"Goddamnit." He swore softly under his breath, stopping in midstride as he caught sight of what waited for him just outside the building. It was a mob scene. Mobile television vans, radio cars, dazzling lights, popping flashbulbs, a gleaming forest of waving microphones and a mass of shouting faces mixed in with the lot, barring the path to his car. Charles Keith glanced at his watch and cursed again. He didn't have much time to get to the airport. He'd have to work his way through that bunch.

He pushed through the door and immediately was besieged by newsmen snapping pictures in his face and struggling with one another to reach him with microphones. They were like animals fighting for scraps of words . . .

"Doctor Keith, are you—"

"Mister Keith," he snapped. "Not doctor."

"—on your way to Washington?"

"No." He started using his elbows. Someone tried to block his feet and he kicked, short and hard. A yelp issued from the crowd. Keith kept pushing his way to the car.

"Have you talked to the White House?"

"Who's responsible for withholding the news? How long—"

"Why are they stuck up there?"

"They're marooned, ain't they?"

He stopped and almost at once the roar died down. He looked at them, appraising, judging. "All right," he said

finally. "I haven't much time. Ask your questions and I'll try to—"

"Why hasn't there been any confirmation that three men have been lost in space?"

"Because no one has been lost. That's nonsense. Next question."

"Isn't it true that Pruett, Lloyd and Stone are going to die?"

"Everybody's going to die."

"I don't mean that, I mean—"

"Will you confirm that their main engine won't work and that they're running out of oxygen?"

"I won't confirm anything of the sort. There's an unusual cyclonic storm building up to the south of Florida. The meteorologists are anxious to have some direct observations. We're giving it to them. The Ironman crew is expert in this field."

A big man shouldered his way forward. "Let me get this straight," he said. "Ironman One is still in orbit, right? One orbit every ninety-four minutes, right?"

Keith nodded.

"They separated a few days ago from the space laboratory. Are you telling me, despite everything we've heard, that they're not in any trouble up there?"

Keith held his gaze. "They are in no immediate danger."

"That's not what I—"

Another voice, louder. "There's a rumor that the men are already dead."

"I'm not responsible for rumors. I can tell you without any qualification they're alive and healthy."

"Have you talked with them? Personally, I mean?"

"I have."

"Well, if they're not in trouble now, and all we're hearing are rumors, what happens if you can't get that main engine to fire?"

"We'll face our problems when we meet them."

"But what if it doesn't fire?"

"There's no reason why it shouldn't. That engine has never failed."

"Mr. Keith, there's a report from Washington that claims every test lab in NASA is trying to find out why the Ironman spaceship won't—"

"I've stopped, I've listened to you, I've answered your questions. Now, will you please let me through?"

Still shouting, they made way. Keith opened the door to his car, slid behind the wheel, shoved a final microphone from his face, and started the car. The newsmen melted aside as he gunned the engine. He made certain not to take off with screaming tires.

Damn jackals, he thought . . .

Was there no getting away from it? Charles Keith sped down the highway headed for the airport, hoping he wouldn't be too late to catch her before the plane left. How the hell did the word get out? Who leaked the story? Of course, holding off on the retrofire was unusual, but that had happened before. They'd delayed the retroburn in the Gemini program, they'd done it several times in Apollo, they'd be doing it again as a matter of course. Even the Russians had shifted their retrofire time around to meet local weather, technical and other considerations. You didn't get a flap out of it every time. Someone had leaked the story, all right, but whoever got the news hadn't been that sure of his ground. He . . .

". . . latest news bulletin on the progress of the Apollo spacecraft, Ironman One, with Astronauts Jim Pruett, Buzz Lloyd and Stoney Stone. A space authority spokesman denied just a short time ago that—"

Already! They weren't wasting any time . . .

"—America's three astronauts at this moment in orbit about the earth are in any grave peril. Charles Keith, the chief of manned space flight for NASA, ridiculed reports that the three men are already dead or dying. He stated that the delay for their return to earth was caused in part by a massive storm system building south of Florida, that scientists are anxious to have observations from space of the storm. However, this seems to this reporter to be something other than the complete truth, since the three men of Ironman One have had plenty of time during their six months in space to do this kind of observing. In addition, there are at this moment four weather satellites in orbit around—"

He turned off the radio. It would be the same everywhere. He had to get his mind off . . .

He took the ramp leading to the airport parking area. Moments later he was in the main terminal building, looking quickly about him. Few people were around; the huge structure was almost deserted.

Keith's glance took in the coffee shop. Several people at

the counter, an old man slowly mopping the floor, someone at the cigarette machine. But not the person for whom he was looking. He looked around again. Then he heard it. The sound. A dozen transistor radios, it seemed. At the far end of the terminal a television set and a small group clustered about the screen. People listening intently. He knew to what they were listening. The scare stories. The rumors, the conjectures, the editorializing. The media had their hands on news with suspense, the cliff hanger they always sought, and they were running it for everything it was worth. To hell with it . . .

He walked quickly down the long corridor, his heels echoing before and behind him. He was anxious to reach Gate 22. He hoped she'd still be there. He quickened his pace and didn't see the nineteen-year-old girl sitting on a bench.

"Hey!"

He stopped short at the sound of her voice. He turned to see a beautiful young girl, arms outstretched, rushing toward him.

"Priscilla!"

His daughter threw her arms around his neck, hugging as hard as she could. "You didn't even recognize me," she laughed, taking his arm.

"No, I didn't," he admitted. "If I'd gotten a good look at you I think I'd have whistled first." They laughed together, walking toward the gate.

"You waited for me," he said quietly.

She nodded. "As long as I could," she said. "I so wanted to see you before I left, and, well, there's another flight in—good grief, I've got just a few minutes before they close the gate."

"I'm pleased," he said. "I almost didn't make it."

They walked in silence for several moments. He didn't see the troubled look on her face. He was content to be this close to her before she left for Europe for several months.

"Daddy?"

"What is it, hon?"

"I shouldn't be bothering you, I mean, well, we have only a few moments." He studied her face. "It's true, isn't it," she said quietly, sure now of herself that she could see his eyes.

"You mean—"

"Uh-huh. Those three young men. They're in trouble, aren't they?"

"Yes," he admitted. "We haven't much time. What do you need?"

She grinned. "Money."

"Didn't I give you a check the last time I—"

"January."

"Haven't I seen you since January?"

"Nope."

"Hell of a father." He pulled his checkbook from his jacket and scribbled a check for a thousand dollars.

"Wonderful. More than I need," she said, kissing him lightly on the cheek.

"About this boy," Keith said. "Is he going to be in Paris with you?"

"Of course he is. Silly," she added.

"I've given up giving you advice about these things."

Her smile delighted him. "Then don't."

"But I should, damn it. Actually, I like the boy. I just don't understand a thing he says."

"You have different interests."

"Is that it?"

They heard the final boarding call.

"How are you?" she prompted. "Are you eating well, or—"

"Tell me about school."

"No time. I'll write you. Now tell me what I asked you before. They're in trouble, aren't they?"

He nodded.

"They can't get down before their oxygen runs out. It's true, isn't it?"

"Yes."

"You're going to save them, aren't you?"

"We're doing everything we can."

"The radio said something about there should be a rescue mission."

"That's impossible, Priscilla."

They walked toward the waiting door of the plane.

"I heard—"

"You think it's up to me?" He tried not to be angry. "There's more to it than—damnit, honey, it's not up to me."

She stood inside the airplane, looking out. They were closing the door.

"I'm sorry," she said. "I'm sorry."

The door closed.

That beautiful, terrifying, awesome scene in the desert convinced Jim Pruett. At the first opportunity he flew to the Pentagon and saw a friend. He asked no special favors; only that when the selection for the third generation of astronauts was made, "make goddamned sure my name is somewhere near the top of the list, will you?"

Pruett flew back to the California desert. He had no time in which to dwell on his hopes for astronaut selection. Men were kicking off to the moon, but in the meantime there was a wicked test coming up with the SR-71. Pruett, with a radarman-navigator-radioman in the back seat of the big reconnaissance plane, was to attempt a penetration of the air defense zones of the United States. No one would know where he was in the air defense system, nor would they know what he would attempt to do. No more than seven men were fully informed of the mission, and these men were told only so that in their critical positions they could prevent any alarms from putting the nation on alert for war. The performance of the SR-71 would scare the hell out of anyone not familiar with the machine.

Pruett's scheme to foil the best electronic air defense system in the world was simplicity itself. With Captain Stan Roberts in the back seat, they took off from Edwards and boomed out to the east at a comfortable sixty thousand feet. Over the Atlantic just off the east coast they rendezvoused with a C-141 tanker and took on a full load of juice. From this moment on they were on their own.

"Jim, I think that storm front in the Gulf will work out just right," Roberts told him.

Inside his pressure helmet Pruett grinned to himself. If their little caper worked out there'd be a lot of red faces at the NORAD center . . .

"We got a full line?" he asked.

"Yep. Solid, nasty line of thunderbumpers. Stretches about four hundred miles and it's unbroken."

"Great."

"Not only that but the tops are between sixty and seventy thousand."

"That's even better," Pruett said. During their pleasant conversation they were headed toward Florida at better than two thousand miles an hour.

"Want dessert?" Roberts quipped.

"A la mode. What's the pitch?"

"The height-finding radar in the New Orleans area is out.

Power failure or something. It won't be working until tomorrow afternoon."

Pruett whistled. "That's made to order. How the hell did you—"

"Don't ask and I won't tell."

Pruett laughed. "Okay. Same plan we discussed before?"

"Yep. Now pay attention to where you're driving. I don't want us running into a UFO up here."

They swept around the tip of Florida, gave fits to the Cuban radar defense scanners and tore for the Gulf of Mexico. Well over the Gulf, Stan Roberts released a decoy missile, a slim shape with a long-burning solid rocket motor that kept flying along their original path of flight. Within the missile a signal generator raised hell. Any radar picking up that signal would get a bounce that matched exactly the radar signature of the SR-71 which, at that moment, was swiftly disappearing from the heavens. Pruett had come back on the power, popped his speed brakes, and was plummeting oceanward at nearly twenty thousand feet a minute. When they were five hundred feet up they were finally level and headed northward for the underbelly of the United States.

They hit the south edge of the squall line exactly on target. At a signal from Roberts, Pruett went to emergency power and sucked up the nose in a steady four-g pull. The SR-71 thundered with power and ripped upward at a seventy-degree angle, climbing with a speed of six miles a minute—vertically. No radar could pick them up along the south wall of the squall line, and none did. When they topped the storm and appeared on radar, the operator couldn't be certain whether he was scope-reading an airplane, a UFO, or interference from the electrical output of the violent thunderstorms. The blip on his scope seemed to be moving slowly. This was exactly as Roberts planned. Without height-finding radar, all the man studying his scope could see was a slow-moving blip, because the SR-71, in terms of covering ground, was still moving slowly.

Pruett leveled out and streaked to the northwest. By now the radar operator *knew* his set was in need of repair. The slow-moving radar target had speeded up to nearly two and a half thousand miles per hour, and that was crazy. Or else it was a UFO, and no one in his right mind reported UFO's any more. He marked it down on his log and didn't tell anyone.

High over the Rockies, Stan Roberts smiled to himself and

released three small missiles. They shot away from the SR-71 in a broad fan pattern. Two minutes later, each missile screamed in a high-pitched electronic voice that painted scope nightmares before two dozen defense radar operators.

Pruett went to open channel. "We have arrived—" he began, smiling broadly.

Taxiing along the flight line at Edwards, worn out from the long and grueling mission, Pruett spotted his commanding officer waiting for him. Pruett waved in return to the colonel's greeting.

"What's up, Charlie?" Pruett slid down the side of the fighter, watching the other man. The colonel remained silent for the few moments Pruett needed to divest himself of his quick-release pressure suit and gear. They climbed into an air-conditioned pickup and started toward Flight Operations.

"You got a lot of people upset last night," the colonel said.

"I hope so," Pruett answered, groaning as he stretched. "Christ, that was a long haul."

"You also got a great many people overjoyed," the colonel went on.

"The project office?"

"Uh-huh. Right now James R. Pruett is the fair-haired boy of the whole SR-71 team."

Pruett made a mock bow. "We aim to please. Did you come all the way out here just to pat me on the back?"

"Jim, how bad do you want that astronaut slot?" That was like Charlie Howard, all right. No leading up to anything; just spit it out.

Pruett looked carefully at the colonel. "Jesus Christ, Charlie—"

His commander smiled. "Guess I knew the answer to that one before it came out," he admitted.

"You never ask a question unless you know the answer beforehand," Pruett said. "Now, level with me, Boss, because you wouldn't be here playing chauffeur unless you had some—"

"First things first, Major," the colonel broke in, parking before the operations building.

Pruett didn't get out. He felt glued to his seat. "*Major?*"

"Sure! Your gold leaves are right here—" Howard patted his shirt pocket. "The word came in yesterday—no, a few days ago really, while you were back east in the puzzle palace, trying to go over heads and cut some of that red tape. It

worked, I guess." He jabbed a finger against Pruett's chest. "And don't forget—cigars all around, *Major*."

"*Will you tell me the rest of it!*"

"Oh, nothing very much," Howard said casually. "I just wanted to save you the trouble of unpacking."

Pruett kept his silence.

"While you were on your way back from Washington, *Major*, a telegram arrived for you. Naturally, I opened it. I didn't tell you what it said because we wanted all your concentration for that little jaunt in the dash seven one. But the telegram's the reason I gave you the red carpet treatment tonight." He grinned at Pruett. "Or is it morning already? I forget things so easily."

"So help me, Charlie, if you don't—"

Colonel Howard laughed at the look on Pruett's face. "Okay, okay, don't get so violent." He chuckled. "Here's the rest of it." The pause was long and deliberate. When Pruett seemed ready to burst, Howard went on.

"You're in."

Pruett gaped.

The colonel nodded slowly, savoring his friend's happiness. Then his mouth flew open with a gasp as the exuberant pilot slammed a hand against his back.

"Charlie, you old bastard!" Pruett yelled happily. "You kept me hanging all this time, when you—" He spun on his heel and started running, calling back over his shoulder. "Thanks! And I'll see you later, Boss."

"Where the hell are *you* going?"

"No time to waste, Boss. Gotta pack right away."

"Pruett, you damned idiot, you're *already* packed!"

"What? How? I mean—"

"I already told Celia. She's got your bags all ready for you."

"You mean she knew and—"

"Under oath and all that jazz. That seventy-one mission was important."

Pruett nodded slowly. "Yeah. Sure, I guess it had to be that—" he stopped in midsentence and grinned like an idiot.

"C'mon," his commander growled. "Early as it is I'll buy you a drink. Maybe it will calm you down a little and—say, wait a moment. Isn't Captain Dougherty a friend of yours?"

Pruett nodded. "Why? Nothing's happened to—"

"He's on that list with you."

"*Ted* Dougherty?"

"Yeah, that's the name. Same type who went through school here with you."

"Well, whaddya know. Things are looking up all over." Pruett threw his arm around the colonel's shoulder. "Let's go and have that drink, Charlie."

They had more than one. What Pruett remembered most about their final session together was the moment when Colonel Howard turned to him suddenly. "I want you to remember something, Jim, when you put your ass on top of one of those big afterburners and hike out for the moon."

"Remember what, Charlie?"

The colonel brushed his fingertips across the wings on Pruett's flight suit. "Remember these, Jim?"

"Of course, but I don't—" his voice trailed off as he glanced down at his own wings.

"That's right, chum," Howard said. "Astronaut wings. You're not going anywhere to be an astronaut. You're already on that team. You're just changing jobs." He touched the wings for a final time. "Just don't forget where you earned 'em, James."

"I won't," he promised.

NASA didn't waste a moment with them. Pruett and Dougherty joined fourteen other new selectees to the astronaut corps. They both had a number of friends among the spacemen; virtually all of the astronauts began their careers as fighter pilots and test pilots, and many paths had crossed before. NASA was working on its long-range plans for space missions with staying power. If Pruett wanted a guaranteed slot in vacuum then, he learned, the odds were against him if he opted for one of the Apollo landings on the moon. Most of the crews were already selected. The remaining slots for nine astronauts would be filled from a pool of more than fifty-six men who were available. But the planning for the first space stations to be orbited by the Saturn IB, using the upper S-IVB stage as the tank for living in space, required men who would know the systems from every different angle, know them so well they could take them apart and reassemble them in the dark. It was a longer haul than the lunar program, but he was guaranteed the mission. And something else appealed to Pruett. The idea of *living* in space, being weightless for months at a time, appealed greatly to him. There was another dividend. If the first orbital lab mission

went off as planned, the tremendous pressure it would exert as the months went by would almost certainly insure Pruett a place on the team that would attempt to set up the first permanent lunar base. For that sort of mission, staying power rather than an exploring nature was the requirement.

Pruett chose the Orbital Laboratory.

Ted Dougherty was always a gambler. Of the fifty-six men eligible for the last three Apollo landing missions on the moon, he was one of the nine to be picked.

It had been a long time since either Pruett or Dougherty had seen Deke Slayton who ran the astronaut program with an iron hand. Every time Pruett thought of Deke and his role in the manned space program from its very inception, he wanted to kick someone.

He first knew Deke at Edwards Air Force Base where the square-jawed test pilot was already something of a living legend. Deke could manhandle a fighter in a skilled fashion that few pilots in the world ever approached. When he flew as a test pilot at Edwards, the personal equipment shop ran out of g-suits, the bladdered garments that helped a man's body to fight off the punishing effect of plus-gravity forces. To fly critical missions without a g-suit was to beg for personal pain that at times approached agony. But the tests were being held up, and they didn't have the g-suits, so Slayton went ahead and flew anyway, *without* the suit. And he built up a tolerance to plus-g that made even old-time veterans blink their eyes. He could pull more than nine-g in a fighter, taking it vertically through the spine, which is the toughest of all, and he did it without the suit, and still he didn't black out. He had everyone at Edwards shaking their heads in awe. When he became one of the original seven astronauts of Project Mercury, Deke pulled more pressure on the centrifuge than any other member of the astronaut team. But he had something in his heart that gave a kick every now and then, and a panel of doctors took fright and they grounded Slayton. Not as a test pilot where the punishment was roughest, but as an astronaut! Deke couldn't believe it and neither could the rest of the team. Whenever his heart "acted up," Deke Slayton had the sure cure, and it wasn't crawling into a bed. Either he'd lift weights or run like hell for a couple of miles—and that put him back into perfect shape!

But they kept him on the ground as far as space flight was concerned, because in those days no one *knew* what might happen to his heart under sustained weightlessness. He still

flew as high as the wings and the blazing afterburner of an F-106 could take him. Once that had been high enough for a teasing sight of the earth's curvature, but only once, and whenever Pruett thought of how close that man had come . . .

A sense of compassion filled him. They'd offered Slayton another world out there in space. Gagarin and Titov and Glenn had gone and they were the only three to rifle into orbit. Deke was to be fourth. They'd offered; he'd accepted eagerly. And he flew his heart out, and worked day and night, and took more punishment than any other man, and was scheduled to go next after John Glenn. Everyone who knew or talked to Deke Slayton knew that Mercury Seven rode uppermost in his mind. The MA-7 mission was everything. And then the panel of doctors, arguing among themselves and the men closest to Slayton, grounded him.

Deke Slayton didn't quit; *any other man, myself included*, Pruett thought, *would have walked straight out that goddamned door and never turned back*. But Slayton stayed, and it was he who shepherded the astronauts through successive generations.

They didn't lock the door *that* tight on Deke Slayton. There were recurring examinations, and tests, and redecisions, and there was hope that one of the two seats in a Gemini spacecraft might be open to him. Finally, to better his chances, Slayton resigned his commission, kissed the Air Force goodbye, and began sweating out NASA's "hopeful promise" for that Gemini flight.

Gemini came and went. Apollo VII booster from the Cape with Schirra making his third and last flight. Then came the first of the manned flights around the moon, with Apollo VIII, and Borman, Anders and Lovell taking the honors. Apollo IX tested out Gumdrop and Spider, the entire Apollo system, in earth orbit. Apollo X went all the way to the moon with Stafford and Cernan slicing down to barely nine miles above the lunar surface. And then there was XI, and commanding that mission was Neil Armstrong, who had flown the old rocket planes and won his wings in the X-15. In the corner was the crew of XII, the all-Navy team, the razor-sharp Pete Conrad, Dick Gordon and Al Bean, "the feisty ones," with Conrad and Gordon having taken honors long before for Gemini XI, the sharpest, tightest mission of the whole Gemini series.

But Deke Slayton didn't make it. The promise failed to

materialize. So Deke played it the way the country needed him most of all. As the head, the boss-man of the astronaut team.

Pruett and Dougherty were together at the Kennedy Space Center for their first eyewitness scene of an Apollo launch to the moon. They managed to slip away from the crowds watching the launch from Pad 39A; the mobs assembled at the press site to the south of the VAB, collected along the shore of the turning basin where the boosters arrived, or simply thronging the area around the VAB. NASA security demanded a 17,000-foot safety area in all directions from the launch pad. They had good reason to be snotty about it. If the first stage of the booster exploded, it would go off with a force of five hundred tons of TNT tearing apart all at once. The blast wave at less than 17,000 feet could be physically damaging, to say nothing of all the debris hurled out in every direction.

But this was to be the first night launch of the Saturn V, and Pruett and Dougherty were having none of this nonsense of standing three and a half miles from the pad. They found themselves a hiding place at a remote camera site. Here they would be protected by concrete walls and sandbags—only 11,000 feet from the pad, much too close for comfort even during a normal launch because of the overpressures of that howling first stage. They would have gotten even closer if that were possible.

They spent the night without sleep. They attended the fitting out of the three moon-bound astronauts in their pressure suits and special equipment. They were behind them as they rode the elevators to the top of the servicing arms of the Saturn V, nearly four hundred feet above the ground. They drank in thousands of details, knowing their role as sightseers was exceeded by their need to absorb and learn as much as was possible to further their own future missions. They checked in at the Launch Control Center adjoining the VAB, watched the teams monitoring every heartbeat, pulsebeat and quiver of motion of the great booster, its payload of machinery and beating hearts. They saw men tie in the tracking stations from around the world, receive real-time confirmation of computer studies that were carried out to the final second, and they measured, along with the hundreds of skilled specialists, the sweep of motion—the rotation of the earth, where they stood, its relationship in time and space to

the position of the moon where it was then and where it would be for the days that were yet to come, all fractions and slivers to make up the splendid orchestration that would result in the lunar landing mission. When all this was done, they slipped off to their secret observation site, stayed low to avoid being seen by the sharp-eyed security guards, and waited out the final moments with a spectacular view of the Saturn V and its lunar payload during its final period of calm before the flaming storm of launch.

Powerful floodlights brought the tremendous booster to them in stark relief. The scene was alive. The Launch Umbilical Tower seemed almost to be clinging to the Saturn V, and would do so until the last fateful seconds before movement. The red-and-white structure loomed some fifty stories above the ground, its colors sharp and clear, tremendous and massive and yet slimly tapered at one and the same time. The blue-white lights poured a visually painful brilliance against the rounded flanks of the Saturn; the lights streamed beyond, painting strange silvery shadowgraphs within the scattered clouds in the sky. The light spilled away and tumbled across the launch stand, the concrete apron, the hundreds of men finishing their last tasks before they fled the scene. The lights flickered and seemed to shift, and they crisscrossed and rushed along the night sky, creating glowing avenues of light that sped up and up until they vanished.

The two new astronauts looked across the Merritt Island Launch Area and shook their heads slowly in wonder. "You know, Jim," Dougherty said quietly, "I've always tried to imagine just what this moment would be like. I suppose I dreamed a lot. But never, never did I realize it would be so *beautiful*. It's—it's *unreal*." He finished in a whisper. "And to think where those guys are going—"

Pruett looked at his friend and nodded. Words weren't necessary. He thought of that booster test out in the desert and he knew this would be altogether different. This was a live bird. Three men rode at the top of a booster and payload that weighed nearly 3,300 *tons*. And where they were going!

To another world. Quite literally, to another world.

Time ground its way down to the final moments. They looked up when clattering drones filled the sky, and big Air Force rescue helicopters, their huge blades blatting in the night air, moved into position to rescue three men should they abort and land in the area beneath billowing parachutes.

Booming horns sounded their deep, rasping call, the final warning cries.

Through much of the night there had been a shrill, high-pitched screaming, the same sound, although much greater now, that Pruett had heard when the X-15 was being loaded with cryogenic fuels, and that he'd heard during the booster test in the desert: supercold liquid oxygen and liquid hydrogen moving through the plumbing system. Earlier in the night the pipes were chilled down and the warm metal screamed in metallic agony. Hissing sounds were added as tanks filled and were vented. And now the pipes sounded mournfully as the wind struck them at a certain angle and brought them to new levels of outlandish outcry. They watched the thick white plumes from the vent tanks of all three stages, they saw the sheets of ice caking the cryogenic tanks, ice that would fall from the first movement in a strange and unearthly shower. A fall of ice to be triggered by a release of flame.

They looked straight across the deserted land at the launch pad, rising high above the ground, with the Saturn V alone and naked except for its blanket of ice frost, its tower, and the three men hidden from view within the command module, so impressive close up, now a miniature toy atop the monster waiting for its brief minutes with destiny. They looked about them, mentally marking their positions behind the concrete and sandbags where they would fling their bodies if the tanks erupted and bright flame came spilling out with savage, unstoppable fury; for they knew they were close, much too close to escape the concussion wave and twisting showers of debris if the Saturn should, for some reason, tear itself apart.

They stood watching the giant, and abruptly the plumes of white vapor streaming from the vent valves vanished. The flow of liquid oxygen and liquid hydrogen to top off the tanks had ended; in his mind Pruett scanned the countdown checklist, knew the tank valves were sealed, and that the tanks were being brought to full pressure to bring the booster to launch status.

It was almost possible to hear the hush, to sense the expectancy of final moments.

The main engines came on simultaneously. There was a volcanic birth of golden flame beneath the giant; no sharply defined flame from five chambers, but a single outpouring of hell. The cataract of golden fire erupted downward, rushed into sloping cavities where it met a Niagara of cooling water;

with a terrible roaring scream heard above the engines the flame shattered against liquid and produced a mountain of steam.

Pruett identified himself with the men lying on their backs within the Apollo and did not know that he had stopped breathing, that he did not release the pressure of his lungs as ice crystals and gleaming chunks tumbled from the flanks of the Saturn, falling freely. *A snowstorm in Hell,* he thought quickly. For the longest nine seconds of his life he watched the flame rage, the thrust building, while the shackles held her down. And ten the mighty steel arms snapped back, the servicing walkways turned from the booster and offered freedom to the raging giant.

From their position so close to the launch pad, Pruett and Dougherty stared in wonder at the blinding mass of golden fire, intense, whipping throughout its substance, shimmering along its edges, bulging down, splashing madly across the launch pad, pushing with savage energy at the bulk of the Saturn. The fire washed down with dazzling force, then lifted, lengthened, stretched further, because the booster was clearing the pad and heaving her bulk into the—no, there was no longer the faintest semblance of night. It had been banished. The light tore into their eye sockets. They reeled back from the sheer fury of what they witnessed. The flame was a ragged spear, still longer with hazy flaming purple gases trailing beneath.

The sound hit them with the force of a truck. It pounded and leaped and trampled everything before it. There was no thunder. It was too loud for that. The shock waves from the five engines mixed and swirled and collided, banging and crashing and slamming together, so that what poured outward in all directions could no longer be thunder, but a series of explosions, coming staccato in fashion but of tremendous energy. Each blast, tumbling and crashing into the one before and after, each only a part of a second, was a fierce blow unto itself. It was a terrible cracking roar, a cracking and a crackling, painful to the ears, physical assault against the body, like not-so-distant bombs exploding, yet it was sweet and exhilarating and worth the beating they were taking. It was the glorious and triumphant cry of the giant smashing the chains of gravity, casting away the fetters of a billion years, a billion-throated dragon tasting escape, sensing freedom, springing eagerly to plumb the depths for which it had been hopefully created, the depths of vacuum that lay along

the uppermost edges of the planet, beyond the world of men to a new world for men.

They stared as the golden color deepened and turned to orange; then red appeared along the edges of the flame. The great rocket was bending over in its flight, the glare too bright for the machine to be visible, for the flame was now more than a thousand feet in length. Almost as if the voice came to him from a great distance he could hear Dougherty shouting, begging, imploring the booster to "Go, go! You beautiful sonofabitch, *GO!*"

The contrail fanned out thick and broad, twisting in the night winds. Then the heavenly swath ended. The flame grew darker, broadened in the vacuum high above until it was miles wide and all they saw of the Saturn V was the bright pinpoints of the engines. It staged; they watched the second stage come alive. They watched it for minutes until their eyes ached and they could see no more.

There were tears on Ted Dougherty's cheeks. He didn't seem to mind when Pruett noticed him brushing them away; he didn't mind at all.

Chapter VIII

"Keep the telephone lines open, then! I don't care how many people want to get through. I want these lines kept open, waiting for my use when I say so! Is that clear?"

"Yes, General. I understand."

"Good! Now, have the scientists at the Moscow computer center brought in any more reports?"

"No, sir. But we expect to hear from them momentarily. They said that—excuse me, sir, Professor Ogorodnikov wishes to speak with you."

"Hurry, man! Put him on at once."

"General Karpenko?"

"Yes, Academician. What news have you?"

"It is as we expected, General. It seems we were correct all the time and that there is something substantial to the first reports we received. There is no question but that the American cosmonauts are experiencing serious difficulties?"

"Is it the braking rockets, then, as we have suspected?"

"That is correct, General. The spacecraft was to have initiated retrofire just as it crossed over the northeast corner, the northeast coastline, of the island of New Guinea. At that moment the cosmonauts would have been approaching—"

Impatiently: "Yes, yes, I know!"

"Bear with me, General Karpenko. We wish to be certain that the data we give you is absolutely correct."

"Forgive me, Academician Ogorodnikov. Please go on."

"We have continued our study of the orbital parameters.

The American spacecraft has an orbital lifetime that far exceeds the maximum possible quantity of oxygen for its occupants. Long before it begins to encounter a significant orbital decay the cosmonauts will be dead."

"You are absolutely certain of this? It is most important to—"

"We are certain, rest assured. There are factors beyond our control, of course, factors which do not come within our knowledge. But they are unimportant. Our calculations are quite accurate, General Karpenko."

"Academician, how much time remains for the cosmonauts?"

"Of this we cannot be positive, General. Much of our information depends upon what the Americans have said about the artificial environment within the spacecraft. But it is possible of course to reduce ambient pressure within the machine, or even to resort to the pressure suit alone, without cabin pressure. They cannot reduce very greatly, however, for their arterial saturation will begin to suffer. We have, however, come to some conclusions."

"And—"

"Please, General. We believe they will exhaust the last of their oxygen somewhere between forty to sixty-two hours from now. This will be well before re-entry. Indeed, the latter effect because of orbital decay may, in these circumstances, be eliminated as a considering factor altogether."

"Then there is no chance of the cosmonauts surviving?"

"No chance that is obvious, General Karpenko. Of course, the Americans may discover the problem with their faulty propulsion system. They may be able to correct their braking rocket, and if they do this before the oxygen is consumed, then all this will be an academic discussion. If they do not achieve this success, however, survival becomes extremely minimal. I understand that they do not have a booster vehicle on any of their launch facilities at this time. That precludes any rescue mission on their part."

"Ummm. Academician Ogorodnikov, from this very moment, from right now—what is the minimum time we may expect the American cosmonauts to endure before their oxygen is consumed?"

"It is not easy to—"

"I would be grateful for your estimates."

"All right, General. There may be modifications to the particular machine, this Ironman, they call it, because of its

long duration with their laboratory. But based on the best of the information we have, in the neighborhood of forty hours. I do believe we could revise this figure upward. But why, General? Does this really matter?"

"Oh, yes! Yes, indeed, it does matter! I am grateful to you, Academician, for all your excellent work. Thank you!"

General P. L. Karpenko, Master of Artillery Sciences, Command Pilot, Corresponding Member of the U.S.S.R. Academy of Sciences, and answerable only to Leonid Sedov of the Academy, spun on his heel and walked briskly into the radio communications room. The guard at the door snapped to attention as the general, ignoring him, strode across the room to a switchboard operator.

"Quickly! Get me Vanichev at Baikonur."

"Yes, sir."

Twenty-six seconds later . . .

"Vanichev?"

"Yes, General."

"Listen to me carefully. The Academy has confirmed our beliefs. Furthermore, there is a time period of forty hours or so at the minimum, perhaps sixty at the outside, until the cosmonauts reach the last of their oxygen. Can we proceed with our plan? Is there enough time?"

"One moment, please, General."

Fifty-two seconds more . . .

"Sir, there is no question. Since your call yesterday, the men have been working without a stop. The guidance system already has been adapted to the new flight plan, and we are working without any delays. Yes, sir, we can do it."

"Fine, fine! But remember, no one besides yourself and your assistant—what's his name? Merkulov—is to know anything about the changes. You are clear on that matter?"

"Yes, sir. I understand perfectly."

"Good. What is your estimate to launch?"

"We must have liftoff no later than eighteen hours from now, General."

"Proceed with your operation, Vanichev. I am flying out immediately. I should be there in four hours or so. Goodby."

General Karpenko rubbed his hands and frowned thoughtfully. All was going as planned. The Americans . . . ah, but what an opportunity! He turned to the switchboard operator.

"Call the airstrip. Tell them to have the engines running and the machine ready for immediate departure."

"Yes, sir."

General Karpenko never heard the reply. He was already running down the long hallway, to the sedan which would rush him to his jet transport, and which in turn would rush him to Baikonur, where hundreds of men were working, had been working since yesterday, without sleep.

General Karpenko leaned back in his seat as the sedan's red lights flashed and sirens wailed; he leaned back, and smiled.

He kept the windows open, relishing the air pounding into the car, whipping through his hair. He could still feel the low-keyed trembling of the anger that swept him as the door to the airliner closed him off from Priscilla.

"I'm sorry. I'm sorry . . ."

As if her words were a final condemnation. What in the name of hell did everyone expect him to do? Pull off the neatest miracle of all time when even God would have turned thumbs down on the chances? The manuals were cut and dried. It took so many days to get a complicated mass of machinery ready and that's all there was to it. It wouldn't have been so bad if they were trying to cut in half the normal countdown schedules. Even if they cut it by two-thirds, although damned few of the people who really knew this business would have based their careers on pulling off such a stunt. But they were talking about cutting everything by more than ninety per cent! They would throw out the nearest window every possibility of safety, every essential requirement of checkout.

Sure, he'd like nothing better than to give it a whirl. Charles Keith on his great white horse and his shining suit whipping everybody to a successful rescue attempt in orbit. Beautiful picture but about as unrealistic, impractical, stupid and impossible as one could get. It was all well and good to prattle on about throwing the book out the window and roaring ahead on a basis of by guess and by gosh, but that was so much addlepated crap. Any time they'd tried that sort of nonsense in the past—and it was nothing so extreme as they were talking about *now*—they had ended up with a terrifying explosion and tens of millions of dollars down the drain, and an irate Congress on their hands the next morning.

He could understand Ted Dougherty's anger and his verbal noises. Dougherty and Pruett were friends from years back and without any question Dougherty would stick his neck in a noose to try to save the three men stranded in Ironman

One. But if you did that and you got your head blown off, it was over. Keith would take that same chance himself.

But he couldn't; the morning after the big explosion and the loss of a hundred and fifty to two hundred million dollars, and a dead astronaut on his hands, he'd be here to face the music. The real core of the matter was that he didn't believe, in all honesty, that the job could be done. Emotion be damned. He'd have to play the role he did so often. The official son of a bitch of the space program, and that was that.

But he didn't expect what he'd heard from his own daughter. Priscilla's face had mirrored the shock of her own words. As if he wouldn't do everything he could without prompting by shouting astronauts or his own flesh and blood! If he could get his hands on her he'd paddle her as she hadn't been . . . he forced the grin to his face. Paddle that young woman? That beautiful young woman he'd even walked past without a sign of recognition for a moment? Good God . . .

He thought of Ike Saddler and his crew and his anger rushed through him again. Sure, Ted Dougherty could sweep an army along on the contagion of his own enthusiasm. But Colonel Saddler was one of the best propulsion people in the country. He knew the Titan system better than any other engineer, and knowing it that well, he should have known better than to go along with a harebrained scheme smoking from end to end with emotional whoop-de-do. Blast him, Keith thought with renewed anger. For a few moments he'd wondered if Saddler could really pull it off, but after Keith's recitation of the obstacles, laid out as if on a butcher table with the gore staring them so realistically in the face, all of them had backed down. All of them save Dougherty, and *he* couldn't get one foot off the ground unless the others could all deliver their own pie slices of the miracle they were trying to put together.

Keith tramped down harder on the accelerator. The urge to return to the flight control room was building within him. He didn't know what he could do, might do, but it was his responsibility to be there and face the music and he couldn't delegate that to anyone else. The press was pulling off its gloves and settling down to a bare-knuckles contest with NASA. They were castigating the space officials and doing their best to castrate him. Not even with a knife but by tearing or ripping his balls away. Let them try. What the hell, that's why they paid him the salary they did. But it was more

than that, he admitted to himself. More even than political Washington, which would rise with well-rehearsed wrath as it heeded the swelling murmur of the people that soon would become a thundering roar.

The people deserved to know what the hell was going on. They didn't need it or deserve it in its grisly details. This horsecock about telling the public everything was something dreamed up by an idiot idealist. That's like telling the story of life and birth to kids and being realistic by shoving their noses into bovine afterbirth. It was realistic, all right, but it made you sick.

Charles Keith was against the idea of dragging the public into bed with NASA every time something went wrong. They'd had technical problems before in space and they would have them again; men would accept the risks, and something would happen and they'd walk the thin edge of disaster, as the Ironman crew was doing right at this moment. But first you did what you could to find out what the hell was happening before you screamed *Fire!* in the crowded theater. Because if you didn't and the public through its press media shrieked to know what was going on, and your answer was an honest, "I don't know," then they were out to drag you to the nearest scaffold for screwing up your job. Long ago Keith had determined to be honest with the public, but not when it interfered with his work, or when it led to screaming speculation and televised hand-wringing dragged into everyone's front room. Maybe it didn't always work out the way he wanted it, but he'd never shirked from doing his job the way he felt best, because it was the *job* that counted, not winning popularity contests on television or anywhere else, and . . .

He didn't see the flashing red lights until the highway patrol car, a Texas Freeway Flyer, was pulling around to pass him and force his slowing down. Keith muttered under his breath. How damned fast had he been going, anyway? He didn't remember, he didn't know, he'd never looked at the blasted speedometer. He lifted his foot from the gas pedal and worked the brake, slowing down and edging to the side of the highway until he came to a halt.

Keith sat quietly, his fingers tapping impatiently on the wheel. He saw two state officers in the car and watched one getting out of the vehicle. He was huge, a powerful man with broad shoulders wearing a helmet, a loosely holstered gun, and shining black boots. He walked slowly, sure of himself, to

where Keith waited. As the trooper came toward him Keith heard the end of a routine call over the police radio. A woman's voice was saying, "Six one zero four William Charles Mary, four one, clear." The officer still in the car said something into his mike that Keith couldn't hear. Then the other man was leaning down to the open window.

"Your license and registration, please."

Keith fumbled for his wallet. "Look, I'm a government official," he said. "This is important. I'm in a great hurry."

"I could see that," the trooper said. His voice rumbled as he spoke. "May I have your identification, sir?"

Keith handed over several cards, gesturing. "Here—license, registration. My other ID—Security. I've got to get to the space center, to mission control. It's an—"

The officer glanced through the cards. "Oh, you got things on your mind, all right," he said comfortably. "That's how it happens, Mr., uh, Keith. Forget where you are and then—wham. Its all over then. Nothing left to worry a—"

"Look, this is *urgent*. I *must* get to a telephone," Keith broke in.

The radio came in over their exchange. *"All points seven oh four. 1968 blue Impala, license BC one one zero seven eight. Bring in on code three, Charles—"*

"Would you turn off your engine, please?"

"Officer, don't you understand what I've been saying? I'm Charles Keith. I'm head of the manned space—"

The trooper gestured to his fellow officer as he interrupted Keith. "I know who you are, Mr. Keith. But I also know you've got no brake lights. Your license has expired. Now, you may be able to get to the moon but you're a menace on the highway."

Suddenly the police car was alongside his own vehicle. The officer in the car leaned out the window.

"You Charles Keith?"

"Yes. I—"

"Somebody named Olympus is looking for you."

Keith nearly erupted from the car. He leaned into the police car, jerked the microphone from the officer's hand and stabbed the transmit button. The troopers stared at him.

"Patch me into Command Network Baker to Olympus. Tell Zeus Watchman is on the line."

One officer started to grab the mike but the other restrained him. He'd heard of Olympus before. It was the code name for the White House.

For nearly thirty seconds Keith waited impatiently as he heard the sounds of the computerized switching system taking his call through a series of interconnections to the White House. He recognized a secretary's voice and almost at once the familiar sound of the big voice boomed at him through the police car speaker.

"Keith?"

"Yes, sir."

"Keith, where the hell are you?"

"Sir, there was a problem—"

"What do you have for me, Keith?"

The state troopers moved off several feet.

"Nothing yet, Mr. President. We're analyzing the engine telemetry. The contractor is trying to put a similar engine in a failure mode. Two of our centers are doing the very same thing. We're not leaving a thing undone. We're running down the history of every piece of hardware in the spacecraft."

Not even a momentary pause. "What else can you do besides what you're doing now?"

"I don't believe there's anything we *can* do."

"Umm. You fellows considered rescue?"

"We discussed it, of course."

"What do you think?"

Keith hesitated. He didn't miss the nuances in the question. Not what do "they" think. The President didn't ask for a consensus. He wanted to know what Keith believed.

The hesitation fled. "The chances are very remote." Answer in kind. Straight out.

He could almost hear the President taking a deep breath.

"Let me ask you something, Keith. If I order a rescue mission, do you want to be let out of the picture?"

This time the pause was evident. Keith searched his own mind, struggled for self-truth. It was his turn to take a deep breath.

"No," he said.

Chapter IX

The man in the center of the table, placed at the edge of the stage in the wide and long conference room, hammered relentlessly with a gavel. Microphones jumped and papers flew unnoticed to the floor. The man's face was white with anger, and a cheek muscle twitched visibly, like a nerve reacting to electric shock.

Facing him were batteries of blinding floodlights, stabbing cruelly into eyes that already blinked from the pain of an agonizing headache. The lights accented thick clouds of smoke and, in between and at the bottom of the smoke, a sea of faces and gesticulating arms dissolved into a nightmarish bed of unreal creatures writhing about and pouring forth an avalanche of sound. The gavel suddenly snapped in two and Desmond J. Barnes, weary, frustrated, enraged, forgot for the moment the five hundred newsmen in the room, forgot his position as Public Affairs Officer for Apollo Applications and its first full test with the mission of Ironman One, forgot even the live microphones on the table, forgot it all and roared, "GODDAMNITALLTOHELL!" and flung the useless shaft of the gavel away from him.

The explosive outburst vibrated every loudspeaker in the conference room and brought sudden cries of pain from sound monitors unlucky enough to be wearing earphones at the moment; the outburst and the totally unexpected gesture of the normally staid and cool Barnes worked the effect he had been unable to achieve until this moment. The five hun-

dred newsmen and women began to ease their outraged, vocal impatience; the roar of several hundred voices began to fall away, like a locomotive disappearing around the bend of a mountain.

Barnes drew several deep, shuddering breaths and fought to regain self-control. The anger remained, but he forced it into a mental cage, and his voice was cold and clear as he picked up the microphone.

"All right; all right! If there's another scene like we just had—" he let out his breath slowly, "neither I nor my staff will consider it necessary to suffer this abuse any longer. And this conference will end. Right here and now."

He glared as the murmuring began anew. "Hold it! It's impossible to answer or even understand a hundred questions all at once! Can you select a spokesman? One or two or several of you to speak for the group? We'll never get anything done like this!"

The uproar again, but this time directed within the audience, not at the head table where the NASA information staff grasped eagerly at the momentary respite. Tom Stinson, Barnes's assistant, cupped his hand over a telephone speaker and leaned toward Barnes, his mouth close to the other man's ear.

"Mission Control on here," he said. "They're not going to help, Des."

Barnes's cheek muscle jerked. "Go on," he rasped.

"They won't give me much. They say we're to stick to the original story. We couldn't bring Pruett and the others down as planned because of rough seas, changing the landing zone and all that, and because the weather people want some coverage of the new hurricane. There's nothing wrong with the men or the spacecraft, that sort of thing. We're keeping them up for a while because of the hurricane. They say that—"

"Cut it," Barnes grated. He ran an unsteady hand through sweat-soaked hair. "It's the same crap. I thought we were finished with this forever. Jesus Christ, Tom, we can't keep up this farce much longer. A good number of those people out there are pros. Hear me? Real professionals. They watched the first Mercury astronauts fly and they know more about this program than you or I. We can't crap them forever! They KNOW we're lying to them. They've played along with us for a while, but no—"

The room was silent. Three men stood in a group by the

center aisle. Barnes squinted to make them out; he felt cold all over. It wasn't good. There was Greg Saunders; he was from the wire services and, God, he was smart as a whip, and dangerous. Jack Kirschbaum from the television pool stood at his left; to Saunders' right was Syd Price. Barnes knew he was from New York and if he remembered right it was the Times. *It didn't matter.*

Saunders began to talk, slowly, deliberately, his words chosen with exquisite care, and as the words came Barnes caught his breath. His anger burst out from its mental cage, then fluttered helplessly as the calculating array of Saunders' remarks slashed through the deception . . .

"—and while we sympathize with your feelings of abuse, Mr. Barnes, we are also sympathetic with the needs of ourselves as a group, and far more sympathetic to the many millions of people who are waiting, who have been waiting for days, to hear what we have to say about what is going on inside that spacecraft, and what really is happening—not your nonsense—to Pruett, Lloyd and Stone. You've been playing God with the lives of three men and that's over with, as of right now."

The voice began to cut deeper and deeper, and Barnes knew what was coming, and there wasn't a damn thing he could do to stop it, even though he saw the roof caving in on them . . .

"—that never did we expect to be in this situation. Mr. Barnes, I am speaking now for all of us, and—"

Saunders' voice took on a note of contemptuous mockery:

"I want you to understand that we shall carry this story exactly as I am stating it to you now."

Here it comes, Barnes thought, gripping the table, knuckles white. Both barrels . . .

"Mr. Barnes—you are a liar."

Absolute, frigid silence.

"We have known for some time that the NASA statements about continuing the flight of Ironman One beyond the scheduled time of retrofire were simply a smokescreen. There is no problem with the weather in the original splash area. There is no storm. The idea that you would keep in orbit any longer than necessary a crew that is exhausted, whose mission was cut short of schedule, so that they might eyeball a hurricane thousands of miles from their splashdown area, is insulting.

"Now, we agreed to your request for this press conference

to be held as a closed-door session. We didn't like it then. We don't like it now. It stinks. But we agreed to it and at this moment we're still sticking to it.

"But unless you level with us—right NOW—we will break the story as a deliberate lie, a sham, a conscienceless deception to disguise the truth that three men may be doomed, just so that certain high NASA officials may be protected in their jobs.

"Now—do you level with us, or not?"

Barnes thought swiftly; thank God for Saunders; he could have been a lot rougher. His mind raced; he couldn't keep the official story any longer. They all knew he was lying; none of them would hold it against him personally. If they were standing in his shoes they would—with all regrets—do exactly as he was doing. Better to say anything for a while until Mission Control quit screwing around and came out with the meat of the situation. He shook his head to focus his thoughts. To hell with orders. That pack out there was hungry; he had to lay this on the line . . .

"All right, Saunders. But before I say anything, I want to tell you—all of you—one thing. What I say now is still off the record."

"Bullshit!" Someone in the crowd shouted the word; angry cries of agreement started a new uproar.

Barnes put up his hand to quell the shouts. "Damnit," he cried, "I'm speaking this way because I have to. I must stay off the record until I get confirmation of certain facts. Facts, not rumors. But if nothing happens in the next hour, within sixty minutes from right now, I'll consider all bars down and everything goes. Do I have your word you'll honor my confidence in you?"

Saunders, Kirschbaum and Price looked around the room. There were angry mutterings, but no spoken objections. Syd Price, a powerful man with oxlike shoulders, bellowed at the group. "You got a bitch, let's hear it now! Otherwise we go with the man. Any questions?" No one said a word. Then Kirschbaum spoke.

"All right, Barnes. We'll buy it. You've got fifty-nine minutes left to go."

Barnes spaced his words deliberately, slowly, going for the shock effect. The truth now would mitigate the lies of before.

"Coming up on their fourth orbit after separating from the S-IVB tank, the crew of Ironman One set up their retrosequence.

"All readings up to that point were perfectly normal. Crew checks were consistent with telemetry.

"Then—" He paused.

"Get to the point!" a face in the crowd yelled.

"Quit stalling, damnit!" another one bellowed.

Barnes stared into the dazzling lights.

"The main engine of the SPS failed to fire."

He had never seen a verbal thunderbolt before; for the first time he saw its effect upon the men and women before him.

"We—we are trying to find out exactly what the situation is. I don't k-know any more than that at this time."

"The sons of bitches!" someone cried. "They got three guys up there about to buy the farm and they've been crapping us about a goddamned hurricane!"

"Watch your language! We're taping and—"

"Up yours, mother." The words came out in a snarl.

"Barnes, damn you, are the orbital parameters we've been getting the real ones?"

Barnes nodded. "Yes."

"You sure or is this some more of—"

"I'm on the level with you now!" Barnes shouted, desperate. "The orbital figures are correct."

"What happened to the big engine?"

"We—I—don't know."

"Can they use the RCS to deorbit?"

"I don't think so."

"You don't think so? Jesus Christ, just say yes or no!"

"How much oxygen they got left?"

"Do the wives know?"

"Has the President been informed?"

"Where the hell is Keith? Someone get his ass in here so we can—"

Barnes felt his legs go to pieces under him and he collapsed into his chair. He started to speak to his assistant, then hesitated as Saunders gestured for silence. But the newsman never said a word. He didn't have the chance. A man at the far end of the conference hall burst through a door.

"It's on now!" the man gasped out. "They're carrying it live on television from New York. The whole conference! They s-say its an exclusive from Houston. They say that the spaceship rockets don't work! That the three astronauts are going to die because they're marooned in space!"

Angry shouting—cursing—a wild scramble for the doors

and emergency exits as the outraged newsmen ran for telephones. They poured from the conference hall in a flood, their anger an almost visible aura. They had been scooped, and badly, in the greatest story of space ever to break. But who the hell . . . ?

Less than thirty people remained in the hall where there had been five hundred. The newscasters for two of the major TV nets held up their mikes and telephones to indicate the dead lines.

Barnes stared helplessly from the table on the stage. He saw Syd Price walk across the room to a television reporter, a popular science reporter. Price reached out suddenly, ripped the headset from the man, raking an ear with a bloody slash as he did so.

Price listened to a voice in the earphone, and turned in disbelief to Saunders and Kirschbaum. "It's live. God help us all, he's been giving out the whole thing just as it was happening here."

He dropped the headset and whirled suddenly, savagely. Two hundred and forty pounds of enraged ex-paratrooper were behind the fist that smashed into the face of the television reporter.

It didn't matter, really. Because all hell was breaking loose around the country. . . .

The night launch of the Saturn V was the last moment of relaxation with space systems Pruett and his crew would know for months to come. Getting ready for the first flight in the Apollo Applications Program, the long-duration test in the S-IVB, meant moving through a world that had seven workdays in every week, and in which every day was filled from beginning to end with more work than could possibly be done. Strangely enough, there would be long periods in which he didn't even see Buzz or Stoney; the other two astronauts were in different parts of the country, working with the manufacturers on special equipment or taking special training, or testing new suits, or some damn thing that kept them on the merry-go-round they had all come to know. Pruett as commander of the mission seemed to face a series of hurdles that reared suddenly before him, and which required all his effort to clear; obstacle over, he could slow down to the normal, everyday, maddening pace. For a while Ted Dougherty worked closely with him on the Apollo spacecraft itself, but

then Ted got the word on the lunar mission and seemed to vanish like smoke in the air, plunging into his own wicked schedule.

Pruett had to learn two new worlds. One was the Apollo spacecraft itself, the command module of Ironman One. The other was the S-IVB, the capacious interior of the rocket stage fitted out as their home in space, a shell more than fifty-eight feet long by nearly twenty-two feet wide. Loaded with their working equipment but empty of liquids, their home-in-space weighed more than fifteen tons, excluding the multiple docking adapter, the astronomical test equipment, or the Ironman spacecraft that was made up of the command and service modules. Pruett learned every aspect of the Apollo CM until it was as familiar to him as a fighter plane he'd been flying for months. For a period of more arduous months he learned the world within the confines of Ironman even more intimately than anything with wings on it. It became the single dominating thing in his existence as he labored to know, instinctively as well as consciously, every square inch of its surface, every tiny detail of its equipment, every move its systems and subsystems made in their operation.

But he and the two men with him would spend only hours in the command module, while they would spend months within the S-IVB tank itself. Whatever he had to know of the Apollo was dwarfed by the demands of knowing down to every last exquisite detail the systems of the space laboratory. In the latter category he knew that Buzz Lloyd and Stoney Stone would know even more than he, because they would be the specialists with detailed assignments, leaving him free to concentrate more on overall evaluations than the nitpicking for which the scientists were screaming. He would also be able to attend to some of the tests and requirements about which they made very little noise, and to which absolutely no publicity was given—the military systems equipment. It was probably the worst kept secret of the lab. Ever since the Air Force was shot down early in 1969 with their man-in-space program, the MOL military requirements had become an inevitably more demanding factor in the NASA missions.

Many men had been weightless by now, and more would be weightless in the continuing assault on space by both the Americans and the Russians. To these men, and the few women the Soviet Union sent into orbit, weightlessness had been an experience. To Pruett, Lloyd and Stone weightless-

ness, the complete absence of gravity, was to become a way of life. It was something to which Pruett, with limited zero-g experience in research craft such as the special F-104 and the long black X-15, looked forward with eagerness. Nikolayev, back in the days of Vostok, was the first to perform a limited space ballet. Floating in midair, completely weightless, he grasped a cabin projection with one hand, balanced his body carefully, and spun himself about. He whirled around and around in a delightfully free movement without any additional effort, and ended the motion only when he grasped something to stop the spinning.

The astronauts who flew the old Mercury tin can flew in a knobbed, studded telephone booth in which they couldn't do much more than shift their positions. Gemini was better but not *that* great, and two men in Gemini had a great deal less room than did the Russians in their Vostoks, or even their Voskhod. When the United States started flying Apollo for the first time, the astronauts, unencumbered by their pressure suits, had the means to slide, float, bounce, spin and whirl around a bit. The Soyuz, however, was the cream of the crop, its huge spherical cabin, one of which was free of protrusions and encumbrances, a delight in which to float about.

But none of them would match the interior of the S-IVB which, in effect, was the first space-going *house*. It was divided into floor levels, compartments, rooms and all manner of work, living, and rest areas. It could hardly be considered the Hilton in orbit, but it was head and shoulders ahead of anything else ever boosted away from the planet.

Pruett could never lose the sense of wonder with which he thought of their home in space—what would be their home in space if the launch went as intended. In orbit, the entire assembly, excluding all equipment added on and docked, weighed over thirty thousand pounds. Yet it would plunge around the world at nearly 17,500 miles per hour with no more effort than the earth plunging around the sun. They'd be living, in effect, in a rigid-skinned balloon, and the thought of a balloon whipping along at some five miles a second staggered him. Not only that, but their bulging cylindrical domicile would endure temperatures from a few hundred degrees below zero to several hundred degrees above zero, a range of well over 550 degrees. And throughout its lifetime, starting on the launch pad, it would have to shrug off pressure variations extending from complete vacuum to loads

great enough to squeeze anything less than the strongest metal into a pulp. It would sustain an unremitting barrage of cosmic radiation, space dust, meteoritic particles, and—Pruett grinned to himself. He hoped they'd never be forced to say: "They sure don't build these things like in the old days . . ."

Pruett directed his thoughts and comprehension of the space lab into what he considered to be its only meaningful relationship—a symbiosis of the men with their machine. It was literally a matter of weaving human systems into a fluid mating with the electronic and mechanical life processes of their space house. They even had, on their long, projected flight schedules, specific times set apart for each of the three astronauts to visit with their families. Each man in space would have the private communications cubicle for personal use. Here, with their families before TV scanners in private booths at mission control, they would exchange the personal items of life so important to them all. The men would talk with their wives and their children. Small talk, mainly, because this is what they would miss most of all. They could see the kids growing, changing. There would be drawings from school to look at, new pets to see and make the proper noises about; there would even be visits with parents or close friends, birthday parties and celebrations, all to be shared through the video-audio link. It would take a tremendous amount of pressure off them.

The psychologists were convinced it was the answer to long-duration space missions. Pruett hoped devoutly they were right.

The three astronauts would exist, literally, within a womb, monstrous though it might be. Only a man who has seen one of these machines with its layers of skin peeled back can appreciate the awesome complexity and interwoven fibers of the space laboratory. Around the three men, below them, to each side, above them, everywhere, there would be a total of more than *four hundred thousand feet* of wires, cables, and lines of every description. Miles and miles of veinous and arterial loops and connections within that confined space, pumping electrical forces, heat, cooling elements, liquids, radiations, bulk matter—oh, thought Pruett, the symbiosis was real enough.

Time and again, immersed in his work, Pruett would emerge from the technicalities and stare in unabated wonder at the naked space laboratory on the ground, their training ground for the final thing that would be sent into orbit, with

which they would join. *The air,* he thought, *the normal, everyday air we never think of consciously, but take for granted, just as we do the heavy weight of gravity which nails us to the earth. But not so to the man-machine system . . .*

Pruett, Lloyd and Stone came to learn, as had so many other astronauts (and cosmonauts too, I'll bet, Pruett thought) before them, that the training and the long preparations were physically more demanding than the actual mission away from earth. The training simulators and special devices were the modern scientific hoops through which they were forced to move with great alacrity, paths of deliberate punishment and tests of their capabilities, but always pointing toward that goal of maximum possible preparation for the effort in space that would climax their efforts.

Some of the torture machines with which they worked had for a time been banished from NASA training. Many of the devices that had plagued the early Mercury astronauts, dropped by the wayside, were modified and brought back into service. With so many astronauts on tap for the comparatively few missions, it proved necessary to keep the crews on their toes. Mercury training, refined and polished on the basis of everything learned in Gemini and Apollo, came many times to bear the focused complaints of the harried astronauts. A modification of the old Air Lubricated Free Attitude (ALFA) simulator was one of the favorite "new" gadgets.

What really stuck in the craw of a man assigned to ALFA was that the damn thing wasn't similar, really, to operating reaction thrusters under weightlessness. It was worse; much worse. Yet the wisdom in its use could hardly be argued. Back in March, 1966, Neil Armstrong and Dave Scott ran into a swift, explosively lethal situation in their Gemini VIII mission. They docked with their Agena target vehicle, and things were just fine, when a thruster in the roll mode jammed and turned their Gemini-Agena into the kind of pinwheel that jams your blood against your backbone and does everything it can to black you out. The rest was history, of course. Neil Armstrong moved faster than any man should have been able to and caught the situation, hit the emergency systems, killed the rotation, and soon afterward started home. During Apollo X, when Tom Stafford and Gene Cernan booted the lunar module—Snoopy—around the moon, they got caught in the middle of a wrong switch position and had Snoopy kicking around crazily through an arc of a hundred

and eighty degrees. So being able to move fast and correctly under the worst possible conditions had more than once proven a life saver, and the pundits gave the orders to drag out the older, diabolical gadgets and turn them loose on the newer astronauts. *Like us*, Pruett grunted during his first time with ALFA. The machine caught him almost completely by surprise. Chagrin as well, because Pruett had made so many missions in the F-104 and the X-15, operating the wicked machines almost entirely by reaction thrusters during the high elements of his flights with the half aircraft, half spacecraft.

Pruett climbed onto ALFA's contour couch and was strapped down securely. The large training room faded into darkness, and Pruett forced himself to remember he was balanced on a great steel ball, with the cushion beneath him nothing more solid than compressed air. He heard the dull hissing roar of the air and, not thinking, shifted his body as he tried to settle down comfortably.

It was a bad mistake because instantly the world skidded wildly out from beneath him. The couch tilted sharply and careened about in a spin. All he'd done was move his butt less than an inch! Instinctively he tried to brace his body to balance himself, but with that exceedingly fine balance of ALFA itself, it only spun him faster and with a new movement to confuse him further.

He cursed; in an immediate black mood, Pruett imagined the laughter of the other astronauts, but *he* cursed himself. He felt the first brush of dizziness and reverted instantly to his most effective weapon in this specific condition, one that had become as much a part of him as any conscious process of thought. The controls of the rocket-powered F-104 and the X-15 slipped through his mind and then Pruett began to blend with ALFA. He forced his instincts and senses to flow into the symbiosis of the man-machine system.

Before his eyes was a lens, and through the glass he concentrated upon an unusual map that spanned a stretch from horizon to horizon of nearly two thousand miles and unreeled before him at a speed of nearly five miles a second—precisely what he would see when the Apollo boomed into orbit. As his concentration flowed to the map, he had the passing thought that he no longer consciously heard the noise of the compressed air; it had started with a room-shaking blast, but now his mind dismissed the roar as effectively as he had come to dismiss the sound of pounding engines. His concentration became total.

The sidearm controller on his right, gripped in his hand, triggered compressed air forces through small reaction jets—the equivalent of the rocket thrusters of Apollo. He could pitch up and down, roll around a point, swing the nose from side to side by moving the controller forward and back, from side to side, or twisting it in either direction. The controls for maneuvering between two bodies in space—rendezvous and docking between Apollo and the S-IVB—required yet another control handle, which was not fitted to ALFA. That would come later, and coordinating the two should be a beauty, he thought with a grimace.

He forced his concentration back to the madcap machine. The "earth" hung before Pruett's eyes and four lines sliced neatly across the reproduction of the curving globe.

Without conscious thought of the movement, he brought up his left hand to scratch his nose and immediately regretted the move. The "spacecraft" wobbled precariously and then began to tilt, and heel over to one side. Instinctively he tried to correct the movement with "body English," at the same time realizing his hopes for immediate counterbalance were worthless. It seemed in the scope that the world was swinging wildly away from him.

Pruett shifted his body senses and reflexes. The reaction hand controller may have been ten times more skittish than those F-104 controls, but balance was something else again. Pruett had long believed that man had six, *not* five senses, and that the sixth was balance. Now he fully merged his senses and mind with the machine and quickly, very quickly, he caught the feel of the simulator. It was a total transference for him; in his mind he *was* in space, he *was* under reaction conditions of zero-g. Just as he used to nudge the Beast or the X-15 through gentle, sensitive motions when he sliced through his high parabolas, so now he nudged the controls.

The trick was a series of compound motions; the trick was to make the wrist as flexible and as loose-jointed as possible. The wrist had to become an extension of the brain. It had to become a long arm of the brain and a whispering touch of the senses, and it had to act almost upon its own volition.

It works! he exulted to himself. It worked beautifully. He brought the trainer around to stability faster than anyone else had ever done it before. He balanced and jiggled it, started spins, caught them in midwhirl, and whirled it back again. He played the hand controller as though it were a flute and his fingers were drumming out the motions.

The technician running the main control panel whistled softly when he cut the air and came down to talk to Pruett. "Nice. *Very* nice, sir," he commented. "You're the first guy in here that ever could match Al."

"Who?"

"Oh. Al Shepard. I watched him way back in the old Mercury days. Al was an absolute wizard on this thing. He caught on faster than anyone else. You hit those things like you were Al himself."

He looked up at Pruett, and the trace of a smile appeared on his face. "Major, would you, uh, like to try some emergency maneuvers?"

There were canary feathers starting to appear on the technician's chin, Pruett thought. He looked at the man and said, "Tell me more, friend; what kind of emergency maneuvers?"

"Oh, I forgot you haven't been in here before. Well, you get it stabilized, see? And then we start giving you trouble. We'll knock out some of the thrusters or give you instability in them. Sort of scrung things up a bit, and see how fast you bring everything back to snuff. Something like really happened with Gemini V. Gordo Cooper and Pete Conrad flew that mission. They lost some of their thrusters and had to make do in a crazy-quilt pattern. But of course, if you're too. tired or worn out—"

Pruett glared at him, and knew that every man in the control room was hanging on their conversation. In a way, he realized he was being tested. Unofficially, of course. He'd completed the entire schedule. He'd met the requirements, and now the test crew were offering him their own hurdles to leap. He could quit for the day; he'd done far better than most of the other astronauts before him. But he'd leave a lot of disappointed people with shaking heads behind him . . .

He leaned back and relaxed. "Let's give it a whirl."

The technician's face lit up with a smile. "Real good, Major! I was betting on you to say that."

The fences were down now. This was straight-out competition between Pruett and the control group. They were going to do their best to drown him in oddball reactions of the trainer, and he was going to do his damndest to stay just one jump ahead of them.

They threw the book at him. Fifteen minutes later the roar of compressed air groaned to a shrieking hiss, and vanished. Pruett wiped the perspiration from his face as the men un-

strapped him. They helped him to the floor and he leaned weakly against the side of the simulator.

"Who won?" he groaned.

Someone slapped him gently on the back. "It was a draw, Major." He hesitated. "And—well, Major Pruett, that's the first time we've ever had anybody in here for his baptismal ride that we couldn't get to yell uncle." Pruett saw frank admiration in the man's eyes. "You'll do fine, Major; *real* fine."

Pruett walked from the test chamber feeling nine feet tall.

He spent most of his time in the procedures trainers, the mockups of the actual spacecraft he would fly into orbit, and in which he would command their ride home. The procedures trainers duplicated in their instruments, panels, and controls almost everything to be found in the genuine article. They were also loaded with "emergencies" of every kind. Connected to fiendish electronic computers and human controllers with minds twisted to conform to that of the computers, the trainers threw fire, thruster, pressure, electrical and other emergencies at the astronaut through every possible phase of a mission.

Nothing gave him fits as much as the great simulator for the S-IVB. The procedures trainers for Apollo were bad enough but the S-IVB lab was so large and contained so much bulky equipment that he felt caught on a slippery floor while trying to climb a greased pole, going in both directions at once. Of course there could be no faithful simulation within the giant mockup of the conditions they would find in space. You couldn't simulate zero-g in a monster of that size, so they were harnessed and trussed up and slung from pulleys to reduce much of their effective weight, and they wandered around the S-IVB like clumsy bats with wings that weren't worth—as DeGroff had dunned into him so many times—a rat's ass. But the equipment kept breaking down and they were required to find the problems, solve them and carry out repairs swiftly. What helped was that they worked together so much of the time. Stoney drove them all against a wall. Nothing got past him. If a machine vibrated or trembled or shook or gagged on itself he knew almost at once what was the trouble and could find the fix with hardly a finger's effort. Pruett and Buzz finally had enough. Stoney went to repair a terminal switchpanel that was supposed to be on the fritz. Nothing he did made it work. Puzzled more than angered, he finally removed the front cover and edged his face

within the mechanism. Whereupon Buzz Lloyd, waiting patiently for the moment, squirted whipped cream in his face. The hidden cameras produced footage that had them in stitches for days.

He begin to stir within his straps. Clayton Stone saw the movement and watched without comment as Pruett shifted, free of bodily weight but encumbered by the thoughts tumbling through his mind. Stone watched the lips moving without sound, the facial expressions as Pruett wrestled and fought within himself. Then, because whatever remained of life promised to be all too fleeting, Stone forced his disciplined mind back to the moment at hand, to surviving. Element by element he stripped the propulsion system naked, and began his dissection. Every machine has a heartbeat and a pulse. Every machine, like the machine that forms man, can have a vital function halted by nothing more than a pinched nerve, a blocked signal, a clotted tube. Stone was a scientist of machinery and he bent his mind to the task at hand.

Pruett went his own way, drifting through memory bidden and unbidden, through recall uncontrolled and controlled, coming up to the moment that was now. He pushed away the clamor to do something immediate. The way to life must be found through the long mindward path . . .

He thought again of his training, and weightless flight, and the word flight *triggered another response deep within his mind . . .*

The comparison was inevitable, and unlike most comparisons it was not at all odious. He thought of winged flight and the total freedom of zero gravity, the weightlessness sustained by that exquisite balance between the massive pull of the planet and the centrifugal force squeezed from their howling booster.

Not until man took delight in what he saw in space and brought away from the globe below his wonder and his laughter, did anyone ever imagine that vacuum and a naked radiation environment might not be totally hostile. Not anyone who spoke aloud or wrote of what it might be like when man finally sailed the seas of space. The word-painted scenes were of harsh and cruel vacuum, of alien and merciless space, eternally hostile, even savage in its utter change from the familiar world of man.

Yet way back in the earliest days of the fledgling probes away from earth, long before any man had yet ventured into the velvety blackness so far above, Scott Carpenter had disagreed with this projection. The man who was to become the second American to orbit the planet had already made the transition to an opinion completely contrary to that held by so many. Carpenter predicted that once a man reached the balance that permitted orbit, he would find space quiescent and peaceful.

Pruett mulled over that prediction and compared what was now known of orbital flight around the earth and around the moon and to the surface of that pitted globe, with atmospheric flight through turbulence and the many other barrier reefs in the sky. There was the need to fight the controls to meet and dampen out thermals and crosscurrents; there were ice and haze and fog that bellied down to the ground and made a runway a tossup between a landing and a blood-splashed impact with the unyielding concrete. Once you went through the needle in vacuum and separated from the booster, well—no more worries about maintaining that even keel and keeping your thrust going where it belonged. You could shut everything down and you didn't need power and your attitude didn't matter because once you were locked into that orbit you were there, and your shape and size didn't matter because it was all the same to a machine like Apollo or to a locomotive. No more sweat about moving the throttle into cruise power or afterburner or compressor stalls; when you got into orbit you didn't bleed off lift and you could forget the flaps and the gear and the dive brakes. If your internal systems were working you had a chance, figuratively, to pull off to the side of the road, shut down your exterior systems and try to figure things out. There weren't any mountains to run into. And those piston jobs—with propeller pitch and throttle and mixture control and carburetor icing and fuel pressure and oil pressure and temperature and cowl flaps and—and a hundred other things multiplied by numbers of engines.

There were clouds almost as bad as mountains. Worse. Pruett remembered all too vividly a thunderstorm into which he had flown and instantly regretted. His powerful fighter was a wisp, a wraith, as the storm sucked him into its maw and then closed its giant, grinding molars on the fragile steel of his machine. He'd suffered a deep and nasty gash from having his head slammed against a cockpit projection. The

thunderstorm was a roaring genie of blackness and sudden, terrifying bolts of savage lightning, and the invisible sledge hammers of wind. Slowly and methodically it began to grind and tear at the big delta jet he was flying; the talons of wind plucked and tore metal loose, and threw him out of the storm like a fruit pit spat with contemptuous ease from monstrous, puckered lips. To save his life he'd fired the ejection seat, blasted up and away from the disintegrating jet. Hail slashed at his face; he threw his arms around his head when fingers of wind ripped away his oxygen mask. Curled up into a ball, his body shaking from the thundering blows of nearby lightning, he fell freely for ten thousand feet. He gloried in the sudden slamming fist of the opening parachute, and all the way back to earth he sucked deep and gratefully of the cool air, and watched the black, towering mass of the storm, already miles away, bristling with tongues of lightning. Far below, there appeared a little flash of red—what was left of his proud, powerful fighter as it smashed against the earth.

How had Scott Carpenter said it would be? Pruett remembered; Carpenter said that once a man got into orbit, he would find it "a very friendly neighborhood." He had called *that* one right on the nose, as the astronauts and cosmonauts who made the trip discovered.

All the violence was—gone. The fuel problem was a simple one; you knew just what you had in the tanks. So many pounds of hypergolics and that was it. And if you didn't want to use the go-juice for attitude control, why, you could shut it off, power down, and let the machine drift. Attitude didn't mean a thing in drifting mode. You didn't dare act in such casual fashion with the needle-nosed and razor-winged swept-back jets, because they would drop like a rock or might even nose up into a high-speed stall, and how often can you survive a violent, cartwheeling tumble at twice the speed of sound? Here you could make a slip, commit an error, and there would be no giant fist to pound you mercilessly for a human fault. Here—up there, flight was attended to for you by the sorcery of five miles every second matched precisely to the curvature of the earth and that splendid, unending fall around the planet.

All things considered, Pruett thought, once a man could accept the unreality of the environment, the knowledge that earth was somewhere else, another *place*—why, the astronauts of the future would still have good cause to look back and say that Scott Carpenter truly was the most prophetic of all

when he described the black void as promising to be a "very friendly neighborhood."

How could Pruett know how deceiving, how sinister that void would become to him? How could he know that even when he struggled against the worst of the violence of the atmosphere, he had the one thing a man needed most of all? He could *fight*—fight the controls, fight the turbulence, fight for his life.

He was yet to learn that the most maddening thing about the death sentence that would be passed upon him and Lloyd and Stone in orbit was that—you couldn't do anything about it. You couldn't fight, because there was nothing against which you could struggle.

You could only wait. Wait to die, while a hollow laugh boomed and echoed through the airlessness of space, a laugh that only he, Pruett, would hear, in the echoing chambers of his own mind.

Chapter X

The two newsmen walked slowly along the edge of Highway A1A in Cocoa Beach. It was best known as North Atlantic Avenue but none of the newsmen visiting the town that called itself Spaceport U.S.A. thought of the main thoroughfare as anything but A1A. The sun weighed oppressively on the air, the road shoulder, on their bodies. They walked slowly, moving to the north, past the Satellite Motel, the ten-story Cape Royal office building with its empty offices, past Twin Towers Apartments and Howard Johnson's Motel; along the strip of sidewalk past the Saturn Apartments, the cars rushing by and hurling damp, hot air at them. They felt the sun, and yet distantly only, for their thoughts and their words were elsewhere. They thought and they talked about a man named Pruett, and another called Buzz, and a third everyone knew as Stoney. They thought about these men whose remaining hours and minutes grew steadily shorter.

Walking in the hot sun, watching the cars moving by, the kids hauling their surfboards to the nearby beach—none of it seemed real if you thought hard enough and could transfer your thoughts above this sweltering atmosphere, and try to imagine what it was like all the way "up there."

One of the newsmen stopped. His friend looked at him, wondering about the sudden look on the man's face.

"John, you were here when Al Shepard made his flight, weren't you?"

"You mean his first flight, or—"

"Uh-huh. The first one. The old Redstone."

The newsman nodded. "Ten years ago," he breathed. "Doesn't seem possible."

"I was just thinking," the other man said, as they started to walk again. "I was thinking—that the most impressive thing about that flight wasn't something that happened up at the Cape. It was here; right here, in this town. Right on these streets."

"I don't follow you—"

"Ted McCoy didn't go to the Cape with us. He covered the shot from here, in Cocoa Beach. You know—the human interest angle. Talk to the local citizens, see what their reactions were, ask them what they thought about a man going into space. The first American. You know what I mean."

"Yeah, I know. So how—?"

"No, hold it a moment." He wiped the sweat from his face.

"Ted told us he'd never seen anything like it. Everyone had radios going, the television sets on. When the count got down to near liftoff, everything stopped. Everyone stopped walking, or talking. Even the people in cars stopped, listening, waiting for the count to reach zero, so they could be sure to look up to the north. They'd be able to see the Redstone lift over the trees and the buildings, only seconds after it left the pad.

"Ted told us—well, he saw people, women, men, even some kids. They looked up and they saw that rocket. And right there, right where they stood, they were praying for the guy in that rocket.

"Some—Ted said that some of them went to their knees and prayed. Right out on the sidewalk, and in the street. They didn't care about anything but that man and—and—praying for him. He—"

The two men looked at each other. Neither spoke any more as they looked across the highway and stared at a white spire. Without talking further they waited for a break in the traffic and crossed the highway to the church.

They found it impossible to enter. The people of the Florida town were those who had sent men into orbit and to the moon and these three men in Ironman One were their *friends. They had filled all the seats and crowded the aisles, and those who couldn't find their way inside the church had*

knelt on the grass and the sand outside, by the steps. A few were leaving; many more were coming.

The two newsmen silently joined them.

They kept one other prize package from the old astronaut training program. This one in its original form went back to Project Mercury. It had been relegated to obscurity through dismantling and storage, but, like ALFA, a use had been recommended for the machine. Engineers modified it to conform to the thruster requirements not only of Apollo, but the new generation of wingless lifting bodies that were already making their first orbital flight tests. Its name was MASTIF and it was a giant abortion of a carnival-house torture assembly that could spin a man about its three axes in the wildest, weirdest tumbling and gyrating that Jim Pruett had ever known. The air-bearing couch of ALFA had been new and different and had caught him unawares; nevertheless, he mastered it quickly.

This monstrosity—the Multi-Axis Spin Test Inertia Facility—had been removed from storage at NASA's Lewis Research Center and reassembled in Houston. At the time Pruett was assigned for training tests with MASTIF it was in use with a half-dozen lifting body pilots. All of them moved quickly to grant access to the newcomer, and Pruett at once smelled trouble. It was a beast unlike anything he'd ever known. It brooded in the giant training chamber, and he thought immediately that some demented erector-set throwbacks had put the thing together during a distressing alcoholic nightmare. Three giant wheels made up MASTIF—three frameworks, placed one inside the other. The outer cage rested on gimbals, and its twenty-foot circular form could tumble nastily end over end. Within this shell there awaited another gimbaled cage, only *this* one spun around and around in the form of a whirling dervish. Finally there came the innermost or third cage, which resembled a capsule assembled only to a certain point, at which time the construction crew became ill at the sight and went home, leaving the job unfinished. At various times the control system within the capsule would be that for Apollo, or the lifting body series, or even for a projected hypersonic aircraft design. What really mattered, however, was that the cage would spin, as though you snapped some good wrist action to a football and sent the pigskin spiraling rapidly through the air.

Pruett's suspicions of the monster were confirmed when he

first heard it complaining; the electric motors were prodding it into movement, producing a distinctive grinding and groaning sound. The great hoops of metal surrounded him in a crisscrossing web, and very quickly he knew why the technicians had strapped him down so tight he could barely move. The bizarre dance of MASTIF almost at once brought home the pressure of the straps that hugged his body so securely to the contour couch.

In the chamber waited Joe Vitello, a NASA test pilot for the X-15 and, for a while, the lifting body program. To Vitello, MASTIF and its unpleasantries were like a pet monster. He could just about play music with the devilish machine, and no one's advice meant more to the newcomer than the words of the chunky Italian pilot. In the control seat himself, Vitello could juggle the forces acting upon him with all the finesse of a high-wire acrobat in a howling wind—lighting a pipe at the same time.

Pruett made every effort to relate what happened to him in the MASTIF to the sensations he knew from flight. Shortly before he left for the training center he was told that he and the other new astronauts would never experience the full touch of MASTIF. Orbital flight experience with all three major space programs—Mercury, Gemini and Apollo—made it obvious that the abuse suffered in MASTIF simply wasn't related to actual conditions in orbit or along a deep-space trajectory. However, there could be emergencies. Besides, it kept the new crop of space heroes on their toes. He found the distinction less than cheering.

The rapid spinning of the three-ringed MASTIF had proven the undoing of more than one volunteer on the carnival-like monster, who tried to scream to be let off, but usually could manage no more than a gurgling strangle as the bile came up and plastered itself along the insides of the throat walls. But Pruett *liked* spins; as a pilot who dearly loved aerobatics, he had hundreds of times whirled earthward in the spin—the rotary stall, whipping around and around toward the uprushing earth. Pruett often would stop a spin, snap the plane out right on point, and kick it right back into a spin in the other direction. His fellow pilots complained that Pruett's stomach was of cast iron and shaped like that of a water buffalo.

When he completed the separate MASTIF runs, one in spiral motion and the other in spins, Pruett was all smiles. "Hey, Vitello," he shouted to the test conductor as the ma-

chine groaned to a stop, "I thought this bear of yours just chewed up space cadets and spit them out in little balls of vomit."

"You enjoying yourself, Major?"

"Yeah. I think my mother might even like to take a ride on this thing if we can get it into the county fair."

"Hmmmm, 'zat so?"

"C'mon, you hairy ape, let's wrap it up. Let's get into the finale."

"Sure. Sure, Major." Vitello reached for the controls. "By the way, space cadet, I'm glad you're enjoying yourself."

His smile should have warned Pruett. But it didn't, and the first sign that all was not well came when his stomach began to protest, not from nausea, but from the unaccustomed end-over-end violence he suddenly suffered. Tumbling faster and faster, torso whirling over and over in wild pitching movements—a complete tumble *every two seconds,* thirty times a minute—was enough to unsettle any man with a complete loss of balance, sense of direction—all the elements of a violent onset of vertigo.

"Y-you b-b-bastard!" Pruett grated through clenched teeth. "You h-hairy bab-*oops!*-baboon, why d-didn't you w-warn me!" Vitello's voice crackled in his earphones. "Relax, space cadet. You can tell Mom what a thrill she can look forward to. *Haw!*"

Pruett groaned as the MASTIF seemed to take on humanly fiendish delight in flipping him over and over. He felt as if all the loose parts of his body were scared at the unnatural forces and were doing their best to break loose of *him*—to rush off somewhere on their own. He could literally feel the liquids in his body sloshing about wildly. And in the background, through his earphones, he heard Vitello happily singing a ditty about astronauts who take their first space rides in the inside of a washing machine.

Pruett sighed gratefully when the MASTIF complained its way to a halt. He lay like a limp rag as Vitello walked across the catwalk from the control room, leaned an elbow casually on the couch, and smiled at the astronaut.

"Hey, Joe," Pruett belched.

"Yeah?"

"I just—*urp!*—got a telegram. It's from Mom."

"Oh?"

"Yeah. She said—*baaarf!*—to send you her love, and be sure to tell you to take good care of her—*gasp!*—little boy."

Vitello roared. "Okay, okay, Jim," he said when the laughter subsided, "just stay back in the couch and rest for a few minutes. We're going to 'go over the falls' on the next ride, and I want to be certain you'll be ready. It's gonna be *mean* and I am *not* repeat not joking. If you're ready for it I think you can hack it."

"Should I turn green now or later?"

"Later, later. Now shaddup and listen. We're going to give you all three motions *at the same time*. This will be a full gyrating motion in every sense of the word. And I do *not* want you to act like a hero."

Pruett studied the other man carefully.

"I mean that," Vitello emphasized. "It's possible to have the gyros between your ears get pretty scrambled in this thing, when you're going at thirty RPM in three different directions all at the same time. You may have only the touch of a cold, and if it affects your ear—why, *blooey!* You're in a mental tailspin just like that. So if that happens, *let me know.* Just gargle 'help' or something like that into the mike, and we'll cut the juice to this rodeo queen.

"Now, I want you to be especially alert for fencepost blur. When—"

"Hey, what the hell is fencepost blur?"

"The flight surgeons have a fancy handle for that; they call it vestibular nystagmus. It's the result of getting your insides sloshed around and all scrambled. Your body and your brain are working against each other. It's—it's like watching one TV channel with your eyes while you're listening to the sound from another channel. The messages come in scrambled, and it's almost impossible, especially on the merry-go-round, to unscramble what you're receiving."

"Baaarf!"

"God, will you cut that out!"

"Can't—*urp!*—help it. If I bring it up again we'll all have a—*braaack!*—hot meal. Save you the big pieces."

Vitello rolled his eyes. "Damnit, listen to me. When we get you going, I want you particularly to stay on that instrument panel. You *must* do this, or I guarantee you'll really scramble your gyros and we'll carry you outta here on a blotter.

"This is where fencepost blur hits you. With so many messages of *un*balance rushing to the brain, your eyes simply cannot handle the input. The instrument panel will become a blur but don't let it throw you. It's normal. It's caused not by

the motions, but by the accelerations and decelerations that are involved. You'll get the blur going into stabilization and coming out of it again."

"Gaak."

He stared as Pruett followed with a hiccough. "Hey, you *sure* you want to give this thing a whirl today?"

Pruett belched and waved a hand casually. "Just turn the mother loose."

Vitello did just that.

Pruett's senses were as alert as a wolf on the prowl for a kill. Yet he found it an incredible sensation when he realized he was spinning around and around rapidly, like being seated on a huge swivel chair that had been spun by a maniac of awesome strength; he was also tumbling head over heels, whirling sideways in that spiraling roll. Gyrating in three different directions at once, he realized with wild fluttering of his intestines that if ever there was a machine designed to froth up your insides and turn your thinking matter into loosely jointed porridge, this son of a bitch was *it*.

It made him ill. He was stunned when he realized the fact. He let himself go for just a moment; he relaxed, and yielded to the triple motions of MASTIF, and instantly the machine squeezed him inside and out and Pruett's stomach protested with a soundless, quivering shriek. Bile began to crawl up into his throat; he wanted to vomit, to rid himself of whatever slime was splashing around *inside* him. He tasted salt, and realized with a start that cold sweat had formed a film over his entire face and was running down to his lips.

MASTIF was now tumbling *violently*, and he knew he *must* stop the insane gyrations—all he had now was the one-hand controller, the stick with its back-and-forth, side-to-side, and twisting motions. Without his recalling the motion, his left hand gripped an imaginary throttle, the throttle to which he'd become as accustomed as any part of his life.

While his right hand came alive—sinewy and dexterous through wrist and fingers, turning the control grip into a responsive, living thing—and the MASTIF gradually yielded its hysterical motions, his left hand continued to squeeze by reflex the throttle that was an integral part of flight and a vital key to aerobatic maneuvers. Any pilot caught in such violence and changing acceleration as Pruett now endured knows he must reduce his speed, chop power, lessen the forces on his machine as well as those on his body. Without

conscious thought on his part, engrossed in damping out the severe motions of MASTIF, Pruett's left hand was squeezing and pulling back on that imaginary throttle. Later he found that his nails had bitten so deep into his palm that blood welled to the surface of his skin. In time—and a short time—he mastered the art of killing the tumbling and gyrating and spinning motions rapidly. He also came instinctively to command his left hand to disregard the normal reflex action; like anything else, it was simply a matter of adapting. But he also filed his fingernails down short.

Exactly as Vitello had warned him—and he *was* ready—he watched the instrument panel dissolve into a blur. It was like staring out of a car window at high speed and trying to count fence posts that whizzed past with a visual clickety-clack sensation. The eyes simply cannot handle the overwhelming input of messages. The blurring that Pruett experienced in MASTIF came not so much from the varying motions, but from their onset—the acceleration of building up to the three-way, simultaneous speed of thirty revolutions per minute.

Finally, under his expert manipulations of the hand controller, the world floated down in its many pieces and began to reassemble before his eyes. Everything clicked back into its proper place and he was again in full control.

When he stabilized the grinding beast, he was ready for the sudden return of nystagmus. The blur left steadily, like water receding from a shore, until everything was rock steady, and his wrist and hand moved almost as a creature apart from his body and brain, handling the reaction thrusters with jewellike precision.

He grinned with his success, and earned a greater measure of the same when Vitello's voice came suddenly through the earphones. "Stay with it, cowboy, and you're gonna break that hoss yet."

He did just that.

One thing was certain, Pruett concluded: the MASTIF pushed aside all doubts of his ability to handle the spacecraft through any control maneuvers in orbit. Before the first man ever went into orbit around the planet there were fears that a spacecraft under zero-g might respond with great sensitivity to any small or undue forces, and would accelerate rapidly into uncontrolled gyrations. It was because of this fear that MASTIF came into being. Under the worst punishment pos-

sible, could the pilot of a spacecraft, using the automatic and manual thruster systems, bring the thing back to an even keel, regain full stabilization, and sustain his desired attitudes?

Project Mercury dispelled the worst fears, and MASTIF went into disassembled limbo during Gemini. But then there was Gemini VIII when Neil Armstrong snatched survival from a hat of superb pilot reaction. And there was Apollo X when Stafford and Cernan found the lunar module whirling 180 degrees out of phase. In one of the X-15 flights a pilot got behind the flight schedule and couldn't react fast enough to regain stabilization and came into the atmosphere whirling crazily. The pieces were spread for a hundred square miles. There'd been two occasions with Apollo when a jammed thruster caused fits. Every time, the man at the controls took over and saved the day. The lifting bodies were the worst of all. They teetered on the thin edge of stability and they demanded everything of their pilots, because as good as were the automatic systems, they weren't good enough.

MASTIF came back to life in new form to assure that the astronauts could always hack a situation when it came unglued.

The acceleration built up in a steady, relentless drive, like a great locomotive starting to roll down a steep incline and gaining tremendous speed and mass. It pushed him down deeper and deeper into the couch, a massive hand squeezing, kneading his muscles and flesh. The meter read eight, ten, eleven times the force of gravity, and it kept climbing. Still the force of acceleration grew until he felt as if he were being mashed into a shapeless blob, unable to lift his head or even his arm a fraction of an inch. He suffered drastically from tunnel vision as his angle of sight narrowed alarmingly; somewhere he heard the thunder of the booster pounding at him and he hurt, *but he kept his eyes open, his right hand on the controller, and he tightened his body and tensed his muscles until they stretched like cords, and all through the grayness and the punishment he kept grunting out "Okay! Climbing —okay! Okay!" as the needle on the meter went to fourteen, fifteen, sixteen times the force of gravity. From somewhere unseen a black cloud began to swirl, faster and faster, rearing up in a shrieking roar; the needle read seventeen, an impossible eighteen, it was at nineteen times the force of gravity! and the cloud engulfed him and the roaring in his ears drowned out everything else . . .*

"He's had it—he's unconscious. Cut the power—*quick!*"

The *swish-swish-swish* of air lessened in speed and volume as the giant centrifuge slowed rapidly and groaned its way to a halt. A doctor hurried from a door high above the floor of the centrifuge chamber, yanked open the hatch to a great clam-shaped gondola, and peered anxiously inside.

Pruett was just coming to his senses, his face and clothes soaked with perspiration. For a moment his eyes were glassy, then clarity returned to them and he looked with full recognition at the astronauts' flight surgeon, Dr. James Michaels. The doctor leaned inside the hatch to wipe away the sweat from Pruett's face. Then he crossed his legs and sat on the ramp.

"How yuh feel?"

Pruett smiled like a dying cat. "As if a diosonaur had—"

"Diosonaur?"

"God, I can't even talk straight. Dinosaur. As if one of those damn things had just sat on me."

"Small wonder. You did nineteen point two before the lights went out."

Pruett whistled. "Christ."

Dr. Michaels nodded. "All right, Jim. No more talking for now. Just sit tight till we finish our readings. We're still taping biodata from the sensors on your body. We want a full report coming down through the peak and how long it takes you to return to normal."

Pruett nodded, closing his eyes gratefully. That was the roughest of them all. Over nineteen g! He was amazed he'd remained conscious that long.

Every test pilot or fighter pilot has been intimate with the squeeze of g forces; they're part of the tickets punched for going into and coming back from space. When a man pulls a high-speed jet into a tight turn or hauls out of a dive, the effect is akin to a dozen people jumping into the cockpit and stomping away with abandon. It's worse in an airplane than in a spacecraft. In a fighter you're sitting upright and you take the pressure along the same line as the spine, from head to tailbone. This plays merry hell with your circulatory system because your blood becomes like molten lead, and the heart works madly to push an arterial column of the gluey stuff about twelve inches high to your head. Bingo—you go out pretty fast. In a ship like Apollo you're lying in a semisupine position with your legs raised and you take the g's in a line of chest to back, so you can take much more of a beating

and still be around. Experience helps, and the fighter jocks become acclimated to the effects, and they build resistance to the punishing forces. Instinctively they tense their bodies, because the more a man strains until his nerves and muscles are quivering-taut from the effort, the higher goes his blood pressure, and the better he can withstand the onslaught of many times his own weight.

Pruett never thought consciously of the g's he pulled in a fighter; it had become a way of life. With his own hand on the stick, he could pile on the force and ease it off. But the centrifuge, which was designed to sustain the load, was especially rugged. The great whirligig with its torture-rack seat, and the faithful mockup of Apollo's instruments and controls whirled him around and around and—it wasn't the g's he minded so much, because of that semisupine position. But he nourished a full-blown dislike of the centrifuge because it brought on some wildly unpleasant side effects of acceleration.

Once—at 11.4 g—he made the mistake of forcing his head to the side to look at the wall of the gondola. Dr. Michaels had warned him *not* to do just that. But Pruett had lived with g-loads for years and he'd been in the centrifuge many times and he wasn't about to accept the admonition unless he knew *why*, and he knew it for himself.

So as the gondola flashed around, he turned his head to the side, and suddenly a huge hand flipped the gondola on its side and smacked it crazily into a horrible careening motion. Calling on all his strength, he fought his head back until his neck muscles ached hotly, but he managed once again to stare straight ahead.

He completed the centrifuge run without a word of complaint, but the medical crew saw it happen. There was the video monitor, and the biological sensors on Pruett's body, and Dr. Michaels smiled knowingly when several needles suddenly jerked in their gauges.

Pruett was a pasty white color when the gondola slid to a stop. He didn't realize yet that by turning his head under the circular acceleration and high g force he had severely abused the mechanism of his inner ear; his semicircular canals, the body gyros for balance, had tumbled. With his sensing facilities haywire, he lacked anything more than a pretense of orientation. He didn't yet realize it would take a while for the inner ear to calm down and return slowly to normal.

Dr. Michaels and an aide gripped him strongly by the arms

and led him into the control cab, placing him in a chair. The doctor looked at him strangely. "Jim, bend over and tie your shoelaces."

Responding automatically to the request, Pruett leaned over—and sprawled on his face. He swore he had *tumbled,* and his expression mirrored complete confusion as he was assisted to his feet and out of the testing chamber.

Two hours later, in Dr. Michaels' office, the world settled down to normal. A chagrined astronaut offered the doctor his thanks for the solicitous attention.

"Think nothing of it," Michaels replied. "In fact, to be perfectly honest with you—"

Pruett waited for the worst.

"—the same thing happened to me."

Pruett showed his surprise.

"Only I didn't get my gyros to normal again for nearly three weeks. Of course, I didn't have the experience or the background of becoming acclimated to the forces you airplane drivers find a natural part of your life."

He shook his head at the unpleasant memories. "You should have seen me. I didn't dare bend down to pick up a pencil because I might end up sliding across the floor on my face. My kids thought it was funny and the dog thought I wanted to play, but *I* didn't appreciate getting into bed and tumbling out the other side."

He tapped Pruett's medical papers. "You snapped out of it considerably faster than average for the astronaut group. Two hours is a rapid recovery for the punishment your inner ear took."

Pruett chuckled to himself. He'd taken nineteen g, even a little more. Going all the way to the moon and coming home again, with re-entry at twenty-five thousand miles per hour, a man took less than eight g. The training *was* rougher than the ride.

Weeks and months passed in a blur of training, flying, testing, and more of the same. Hour after hour was consumed in the many procedures trainers and the mockup of their S-IVB lab in which they would live up to a year. More and more they began to work together as their individual programs intermeshed, and they started a serious program of training as a three-man team. Engineers threw a bewildering variety of emergencies at them, everything from loss of attitude controls of the space lab to explosive decompression of the great

rounded walls. They reacted to the thundering clamor of fire warnings by scrambling nimbly into zippered emergency suits and hitting the nearest depressure handles, dumping everything into space. They learned to operate the environmental control system under every possible condition anticipated for their stay beyond the earth, and then they began cross-training for each other's jobs, so that they would never be lost because a man became ill, or even if he were to be killed. The scientific experiments demanded concentration and practice, practice and more practice. They learned the purpose of the tests and the reasoning behind them and became adept in the use of the equipment which they would be operating for so long.

There remained, finally, only one last phase for their mission prior to their departure for the Kennedy Space Center and the last week there before the scheduled liftoff. Because of the intensive medical observations for their unprecedented length of time in space—one of the major justifications for the mission—the medical staff subjected the three astronauts to medical examinations and tests so exhaustive the men found them to be more wearying than the centrifuge. It was one thing to endure the punishment of ALFA or MASTIF or the centrifuge. But the medical tests! Pruett shook his head unhappily as he was led like a prize bull from one laboratory to another.

The analogy became painfully evident when the doctors told Pruett to deliver a sperm sample.

"What the hell for?" he asked, openly astonished. He leered at Dr. Michaels. "Or are you planning to surprise us by sending along a couple of small-sized, fully-developed, nonfertilizing, cooperative, nymphomaniac, space-type female stowaways? What the hell, Doc, we're gonna be up there a long—"

"Whoa, there!" Michaels broke in, laughing. "No such luck. This is for posterity, not pleasure."

"Sez you."

"Sez me. We're using the sperm cells to draw up fertility lines—fertility base lines for you, Lloyd and Stone. You're all going to be in orbit for a long time and that means an unprecedented exposure to radiation—cosmic, solar and God knows what else is up there. Years from now we'll still be taking seminal samples for additional tests. This way we can determine whether or not there's a long-term threat of steril-

ity or a danger of mutative development from your sustained exposure to cosmic and solar radiation."

"Very, very pretty," Pruett scowled. "Except that a whole bunch of people, including that Russian gal, Tereshkova, have been in space and have taken radiation and came home to have very healthy babies."

"Sure they have," Michaels said affably. "But none of them have been up there for very long. Your crew has the distinction of—"

"Never mind, never mind," Pruett said drily. "You're sure I shouldn't get maximum use out of this thing while I know I've still got it?"

"Nothing so drastic as that," Michaels said, handing him a test tube with a plastic cap. "Here, use this. The lab bathroom is right over there."

Pruett shoved the door open. "Hey, Doc!"

"What is it now?"

"Daddy said I should never do this sort of thing alone. Send in some well-built company, will you?"

Michaels threw an ashtray that slammed off the door as Pruett ducked hastily inside.

Technicians took series of X-ray pictures to search out any air bubbles that might exist in the bend between his spinal cord and the so-called tailbone. Such air pockets, explained Michaels to the Ironman crew, weren't uncommon and normally their presence was ignored.

"But where you people are going," Michaels added, "and breathing pure oxygen for a while before you go to mixed gases, and staying in an atmosphere of five to eight p.s.i., well, the expansion of any air bubbles that might be there is inevitable. The pain could be so excruciating that you might have to abort the mission and come down prematurely.

"And it would hardly look very well that you characters had to blow a hundred-million-dollar mission because one of you had a pain in your tailbone."

They X-rayed almost every part of their bodies. They studied with the greatest care the extent to which any arteries had hardened. The medical technicians searched for scars and then they poked and prodded and stretched to determine exactly how much stress the scar tissue and related skin could withstand. They left the Ironman team with eyes watering and half blind for nearly a day after thirty-two different stud-

ies and tests of their eyes. They urinated and defecated in a variety of containers and at odd times of the day and night. The doctors took motion pictures of their heart arteries, and jiggled and joggled their bodies through series of "static and dynamic tests." To be absolutely certain of their levels of body efficiency, they ran tests of pulmonary function, total body radiation count, specific gravity of the body, blood volume, water volume, lean body mass, and even detection of tiny congenital openings between the chambers of the heart.

They were overwhelmingly grateful when Dr. Michaels announced the close of the medical tests and evaluations. They would leave for Florida and the launch area three days from that moment. There would be another week or ten days of final training, equipment checkouts, and last-minute details. During that period they would be isolated from the rest of the world.

"But you've got these three days," Michaels said. "I don't think I need tell you how best to use them?"

Chairs scraped as three astronauts started for the door.

They needed no telling.

Chapter XI

Me. It's because of me they're going to die. Me. Not them. It wasn't their fault. They didn't do anything wrong. I'm the one who messed things up. I'm the one who couldn't remember any more, who couldn't work the equipment. I'm the one who lost the spectral experiments. They weren't very happy about that in mission control. But I couldn't help it! I couldn't get my balance, I didn't know where I was and I had to hang on to something. I had to, I had to—but what about them? They don't deserve to die like this. Two greatest guys I've ever known. For nearly six months now we've been like three sardines floating in a huge tin can in space, falling around the earth, always falling. Heh, that's funny, all right. Falling with no place to go except to fall some more, around and around and around and what the hell did they do to deserve this? To deserve me? If it wasn't for me they'd still be back in the lab and we'd be going for another six months and Jim would have it knocked for the mission he's always wanted for the first permanent base on the moon, he's had his heart set on it, and Jesus but I've screwed it all up, and I can't blame anyone else. We're wrapped up in this stinking cocoon and we're lying here waiting to die while they give us that shit about trying to find out what's happened to the engine, Jesus, is that my fault too? but it can't be, I mean, I screwed it up good in the lab but what did I do here in the ship to mess up everything like this? I mean, hell, Stoney looks after the systems and nothing gets past him and there

ain't no one better than Jim for flying this ship, and all I did was to handle the coordinates and the times, I mean, I never even touched anything with the controls. Sure, that's right, but maybe I did something and I don't remember it. God, I hope that isn't it. I can't stand this goddamned ship any more, we're lying here and we're starting to stink and why aren't we outside doing something? why are we lying here just waiting to die? what the hell's the matter with us anyway? Look at Pruett there, acting like he's sleeping. Said he wanted to think everything over. Sure he did. He ain't so goddamn smart, I know what he's doing, he's trying to figure out where I screwed up, that's it, it's going to be my fault. What's Stoney doing? he's read that goddamned procedures manual a hundred times already, maybe he thinks he can pull a miracle out of that goddamned book. Maybe I should tell them it was my fault, I mean I don't know, I mean, really and honestly know for sure, without any question, that I did it, maybe it's just this stinking ship, and it's nobody's fault but if I tell them I messed up somewhere they won't be blaming themselves, they're the greatest guys I ever knew in my whole life and Jesus Christ, oh my God, I wonder what Betty feels about all this, and if she's told the kids their father is marooned way up there so high they can't even see him and they'll never see him again, God, what do the other kids say to them, I can't die like this, just lying here waiting to stop breathing, Betty, poor Betty and . . . if I don't get out of this goddamned thing I'm going to blow my mind, that's for sure, I'm going crazy, strapped in here like this. Look at those two guys, the way they're taking it, one of them sleeping and the other reading, I know they don't want to talk to me because maybe they'd forget themselves and say something they're afraid to say. Sure. That's it. Why don't you say something, Pruett? Go on, tell me how I put us in this rotten lousy stinking situation that's gonna kill us all. Yeah, do that. You too, Stoney. You got a right to call me a son of a bitch. Why not? In two days we'll all be dead and it won't matter, and Betty, Jesus Christ I don't want to die like this, why don't they do something down there? You bastards, all of you, just waiting down there for us to die. Bloodsuckers, that's what you are, you got all those goddamned computers and fancy machines and you're all so fucking smart so why don't you do something, get us the hell outta here!!!

Pruett went first. He stepped down from the transfer van and moved into another world. Buzz Lloyd was second and Stoney Stone came last. These were their positions in the spacecraft. Pruett on the far left, Buzz in the center and Stoney to the right.

They stood immediately behind him as he looked up, and he knew they were doing the same, overwhelmed by the immensity of the scene towering around them. It was a world of intensely bright blue-white lights, of a deep crackling and groaning sound of machinery. He couldn't hear much with the helmet securely about his head. He couldn't hear the sound of hundreds of shoes moving on concrete and metal. Only dimly could he hear the night wind or the cryogenics venting from their tanks. But he and Buzz and Stoney heard the other sound. From out of the burning arc lights, the garish spots and the deep shadows, against the backdrop of a mountain of metal reaching into the darkness of the early morning, they heard the hands—the hundreds of hands as they were beaten and pounded together, growing in volume as voices swelled the sound. Hands applauding—the men of the launch crew, the men who manned the ground support equipment, the nameless hundreds who made all this possible. The men, *their* team, roaring their approval and their friendship. Here were three astronauts who would not, if all went well, return to earth for a year, and they were being sent off in thundering, rousing style.

Pruett choked back the words he wanted to say, and was instantly grateful that he couldn't, because he was afraid he would stumble over his own thoughts, and that would hardly be the way for the commander of Ironman One to respond to this tremendous, spontaneous ovation from these men. He looked around at them all, and they knew that he and Buzz and Stoney were looking thus, that each of the three men destined for space appreciated this moment, and were sharing it with them. Behind most of them, before the others, loomed the steel mountain soon to explode into life. These were the men who had given their all, day and night, to prepare the towering Saturn and its waiting cocoon high above the ground.

Pruett could not speak to them but he could, for himself and his crew, respond in kind. He stood there for those moments, the scene etching itself clearly, indelibly for as long as he would live, into his mind. In his left hand he grasped the

portable air conditioner that spewed cooling air into his heavy suit. He started to wave to them—a free, a casual and friendly wave. His right arm came up and he started to wave, but almost of its own accord, without his consciously thinking of the desire, his gloved hand came to the helmet, where his forehead would be, and he—saluted them.

Then he walked quickly, Buzz and Stoney behind him, Dr. Michaels to their right, Hans Buettner, the suit technician to their left, the short walk to the elevator. Metal moved against metal and they felt vibration beneath their booted feet and they began their ascent to where Ironman waited for them.

He had the fleeting thought as the elevator lifted above the ground, that they had made it, the whole works, dead on schedule. They had been aiming for this moment and now the vastly complex and far-flung machinery that would precipitate the flame and the upward rush was in motion. The space laboratory waited in orbit for them, waited for their ministrations to come to life. That was a reminder, for more than once they'd looked into the starry night and watched the silvery dot drifting across the sky and through the starfields. Those men on the launch pad were a reminder also. There were more than ten thousand people like them, here at the Kennedy Space Center, at the tracking stations, on ships and within planes, at computers and in tech labs—an army within the nation and around the planet, all superbly integrated in the orchestration that would make all this possible for the three men of Ironman One.

There was little conversation in the elevator. At this point the others deferred any conversation not really necessary for the crew. These precious moments, they felt—and for this the three were grateful—belonged to the men who would not return to this planet for a year. In that momentary quiet as the elevator rose, Pruett's mind moved rapidly through introspection, enabling him to reach out and comprehend what was happening in so many places—then focusing down on this one place, this one moment, on the three men, and finally on himself, standing alone within his mind.

Clothed in white from head to foot, Ted Dougherty met them as they emerged from the elevator. The three suited astronauts shook hands with the technicians who had lived, literally, with their spacecraft for months. They wore their *North American Rockwell* worksuits with obvious pride. They were the same men who had sent other Apollos into orbit and far beyond to the moon, and every one of them had

brought their occupants safely home. Standing before the machine that would hurl them hundreds of miles high, and would finally bring them home, Pruett studied the laboriously painted name on the side of their spacecraft.

Ironman One . . .

The spacecraft crew went quickly to work. Portable air conditioners were disconnected. Plastic boots were removed. Hands supported them as they eased through the hatch into Apollo to their respective couches. Dougherty was with them, moving quickly, watching everything, missing nothing. Buettner was by his side, his skilled hands attending to the electrical, oxygen and other umbilical connections linking the three men as symbiotic entities with the machine. Finally they were all done and only Dougherty was left.

He had a going-away present for Pruett. The commander of Ironman grinned ruefully as he reached out to touch the shining metal D-ring—from a parachute. It was Ted's crowning touch of irony, a token to recall that ejection in the thunderstorm and the descent by parachute that had saved his life. Now he had another D-ring—and *no* parachute, and no place to fall if he stepped outside his space lab in orbit.

Then it was done and the hatch was closed, Buzz reaching up and behind him to secure it in place. They were committed to the great booster and the closing minutes of the countdown. The faces through the windows disappeared, a voice in their helmets told them the elevator was gone. They were alone and waiting for the final rush of time, for the sweep-second hand to reach the fateful zero.

They talked with one another, reviewed their controls and switches and dials, talked with the test conductor in the launch center, monitored the count as the booster was brought to increasing stages of life and activity. They went through a hold built into the count and were reassured for the eighth or ninth time that the clouds in the area didn't mean a thing and the weather would be just fine, and finally they were told the pad far below them had been cleared. They knew they were resting atop a vast pinnacled monument that would explode into life and rush to reject the earth and they paid close attention to the radioed signals from below, checking them off their own checklists, coordinating every movement and every step. They were at T minus five minutes and counting and it seemed unreal when Dougherty in launch control came on the line telling them they were patching in to outside telephones. For another min-

ute the world was theirs. In quick succession Celia, Betty and Teresa came on the telephone and the words were different except the "*I love you*" from the wives they wouldn't see for a long time to come.

Vibration—the barest shudder through their massive mount. Far below them flaring bell-shaped chambers moved on their gimbals as the launch team ran through a last-moment systems check.

The seconds fled . . .

They listened to the count, part of it, the count moving progressively down, the men at their consoles checking in, the great orchestra losing its preparatory discords and sliding neatly, expertly into position for the precise coordination needed to carry the mission to the point of ignition and the flight they now anticipated with a sudden tremble of excitement.

Pruett had often wondered about this—what his emotions, his thoughts would be as he went right to the wire of the mission. He wondered if he would be calm, or if he would be awed or excited. Now he experienced all these emotions and sensations, but each observed by him, it seemed, as though they were on different planes. His voice as he responded to the countdown checks and even the banter from CapCom was completely free of emotion. He might have been seated on a couch and engaged in idle conversation. Yet he felt—he *knew* his senses were keyed to an extraordinarily fine pitch, that his mind encompassed all that was necessary for technical functioning and his duties, and yet, strangely, allowed him to look upon the entire scene almost as an outside observer, deeply moved and excited at what was going on through every fleeing moment. He was grateful for this; he knew his profound impressions would not be obscured in the need for flawless performance on his part.

And then he heard something that brought a wave of emotion sweeping quietly through him. The voices of the two men to his right. The voices of Buzz and Stoney, as calm and crisply efficient as his own, the vital two who completed their team. Without thinking of it, Pruett lifted his head and glanced to his right. They saw the movement and saw Pruett grin at them, and then three thumbs went up in the air and the three men of Ironman One confirmed in that movement what they were to one another. It was a soundless and beauti-

ful moment that made of itself a fitting culmination to the long months of preparation.

One by one the calls came in from around the world: "*Go!*" or "*We are green—go!*" Weather, optical tracking, radar tracking, computers, mission control in Houston, downrange station, status of the booster, status of Ironman, status of the crew, status of the S-IVB awaiting them in orbit; *Go!* from the tracking ships and the aircraft, *Go!* from range safety, from the emergency rescue forces. Item after item fled along the countdown checklist, the number of remaining items shrank, the number of pages became smaller, the remaining minutes and seconds dribbled into nonexistence like grains of sand slipping away forever through a crack in time.

Pruett strained his body hard against the couch harness, tensed and untensed his limbs to be assured there would be no stiffening of his muscles, no unexpected, sudden body fatigue after the long wait on his back.

The launch crew seemed to Pruett like disembodied voices calling to them as the three men in Ironman repeatedly scanned their instruments, checked the spacecraft systems for the hundredth time, ready to mesh into the coordination of the booster coming to life. Then:

"*We are in a GO condition.*"

The seconds winked out of existence. He forced himself into a part of the final count, melted into the chanting ritual, checked off in his mind each item as it gained vocal substance and—gratefully—vanished off the checklists:

"*Inverter switches ON . . . secure lox topping . . . up on pressurization . . . GO . . . water systems to full flow . . . roger . . . we are GO . . . check internal power . . . GO . . . engine arm switches ARM . . . confirmed . . . GO . . . check abort system . . . GO . . . systems final status check . . . range reports go . . . range safety is go . . .*" One by one, beautifully, the men at the consoles responded with that exultant, brief cry:

"*GO.*"

"*Ironman?*"

"*All green—GO.*" Pruett didn't believe it was his own voice.

The final sequence rushed by . . . the electronic brain in the Instrument Unit had taken over . . . they were into prestart and another cry of "*GO.*" Then: there went the space-

craft umbilicals. They felt the sudden thump of ejection. He snapped his eyes around the instruments . . . all green . . . final count . . .

"*Thirteen* . . ."

And exultation swept through him, a fierce cry of joy . . .

"*Nine* . . ."

—wonder, the wonder of this, of *now;* the sudden realization that came rushing to—

"*Four* . . ."

Stoney's voice, speaking for them all: "*All right, you mother, now behave* . . ." A final word-rapport . . .

"*Three* . . ."

—memories flashing crazily through his mind, no rhyme or reason, a parade after the shiny uniforms and the trumpeting brass were gone, and the children laughing were only an echo, and even—

"*Two* . . ."

—the dream here and now, this instant, and of a sudden be hungered fiercely for what stretched impossibly high and above h—

"*One* . . ."

—don't breathe, don't—

"*Zero!*"

It came in a rush of impressions to him, like a kid running along the sidewalk, dragging a stick against the side of an iron fence, and each time the stick banged against the metal, that was an event; and each event now came to him, flickers of events melting into here and now . . .

The engines rumbled and snarled and shook and they could feel the huge pumps ramming the torrents of fuel and far below them there was flame, growing, increasing, hurling back and the tremendous power came to them in many ways of feeling and sound and rumbling and there was movement as the cannonading thunder increased and his lips came back in an animal grin of triumph, and he couldn't believe their voices, his and Buzz and Stoney, talking calmly, so matter of fact it didn't seem possible, but they were calling off the events as they felt the first movement, and they were calling *Roger, liftoff* . . . and there was Buzz's voice *How do we look, you guys?* and someone called they were clearing the tower and the whole thing was absolutely out of somewhere else, so crisp and efficient and calm were the sounds and the voices . . .

"Roger, Ironman. You look very good, very good from here. Everything is go."

Quiet, like they did this every week of the year.

The roar of the Saturn swelled into an ocean of thunder; the movement shifted to a different feel and they were going back in their couches, a deep, wonderful surge upward, unbelievably smooth . . .

"Everything looking good, we're nominal right across the boards, that's a great booster you got going for you. You're in for the money. Did you people remember to release the parking brake?"

"Yeah." Stoney in response. "We cut the lines last night."

"Real sneaky types. Ironman, we're still in for the money, nominal . . ."

The pressure, temperature, flow, power and all the other critical items were right where they were supposed to be. What a hell of a launch team! He gave himself up to the miracle and without thinking he heard his own voice: "That's my girl! That's my baby! Go, baby . . ."

Everywhere they heard that enthusiastic cry and there were smiles and laughter and some of them whispered the same yell with him. They were through the roll maneuver and pitching and rushing upward from the earth even as they bent more and more to the horizon, in the long smooth curve that would lead to their slicing right through the eye of the mathematical needle they needed for orbit in the right place at the right time at the right angle and in the right direction . . . faster and faster, the invisible hand of acceleration, amazingly gentle—a shudder; they were ready for the feeling as the Saturn tore through Max-Q, the period of maximum aerodynamic pressure, and they knew they were leaving behind a tremendous cottony swath, the upward contrail, and then that was past and they were above the stratosphere and going like hell . . . there was a rumble from somewhere far below them and then a sudden light change in acceleration as an engine cut off on schedule and then the first stage slammed down, and they felt the banging sounds of retrorockets igniting, of metal clamps separating and the ullage rockets whispered to them to seat fuel in the tanks of the next stage and then a beautiful, wonderful crash as the next stage ignited and the S-IVB kicked off for her long pull through what was already almost a perfect vacuum. It was

perfect all the way and they began to grin hugely at one another . . .

". . . coming up on SECO. You look good, very good from here. Everything looks like it's directly in the center of the target. Stand by for SECO . . ."

"Roger."

Thunder ceased.

There was a crash of silence.

Acceleration vanished; weight fled.

He tumbled forward—*"No; not so,"* he told himself; just the expected sensation at the end of acceleration.

Wonder soared through him. *They were in orbit! They'd made it! He . . .*

Muffled sounds and vibration as they separated from the booster. *Okay, Pruett. Now you start earning your paycheck on this ride . . .*

The hand controllers came to life beneath Pruett's gloved hands. Ironman eased away from the S-IVB with spats of flame from the RCS thrusters. Far out for safety, Pruett brought the spacecraft around for a good look at the empty booster, tumbling slowly and spewing frozen gases from its aft end. Six hundred feet away from them it turned and rotated slowly, flashing in the sun. There were crystals of white and green, sparkling motes and . . .

He stared, enchanted and hypnotized with the sight of the sharply curving horizon of the earth. For an instant he knew disappointment when the heavens seemed emptier of stars than he had expected; he remembered, then, his eyes were still light-struck from the sun and would require time for night adaptation.

He looked down on the brilliantly blue ocean, marveling at the sharp, tiny clarity of cumulus clouds over the water. Fifteen minutes after liftoff, the crew of Ironman One stared down on the Canary Islands, then the Atlas Mountains of Africa and tendrils of smoke and dust across the desert. Delight in the sharpness of shadows beneath the clouds; the silent wonder, seen through visors, of the great flaming star men called the sun.

Buzz Lloyd removed his straps, grinned happily at the floating sensations of zero-g, and went to work with the guidance and navigation system. The S-IVB tank waited for them, waited for the firings of the big engine in the service module.

Later they would reflect on how perfectly it worked, how it

drilled Ironman One with split-second precision through the complex and intricate maneuverings until they docked with the space laboratory.

Their flight was a significant milestone that bridged the gap from exploring and studying space to utilizing the advantages of being in space for the everyday world of people on the earth. Some said that Astronauts Pruett, Lloyd and Stone were the first Americans, the first men, really, to participate in the long and repetitious routine of flight through space. Until the mission of Ironman One, every step made by the two spacefaring nations of the world, the United States and the Soviet Union, had been essentially an adventure into a new realm. Each of the men and the ships that had gone before Ironman sliced through a jungle of precedents by conducting new tests, new experiments.

Men had found time spent away from the earth to be confining. Frank Borman and Jim Lovell orbited the home planet for fourteen days in the mission of Gemini VII in December, 1965 (three years before they orbited the moon in Apollo VIII), and that was a rough one—spending two weeks cooped up within the small Gemini spacecraft. The Russians kept four men aloft for forty-eight days in two Soyuz spacecraft they called an orbital laboratory, but that was beggaring the term.

Pruett, Lloyd and Stone were the first to set up housekeeping, the first to live and work in space as a permanent routine. They became biological guinea pigs for doctors, they became invaluable for scientists as they carried out hundreds of tests and experiments, and they became routine for the billions of the world. But it was a routine that people came to expect and even more to appreciate as the television cameras of the space lab transmitted sharp color pictures of storms, fires, icebergs and other phenomena of the planet. Their laconic eyewitness broadcasts of hurricanes and typhoons and other storms came to be as expected as the daily weather forecasts and reports from stations chained to the earth.

Their personal lives and experiences left the front pages and the daily news stories and became material for Sunday features, for these were the first men who spent month after month in orbit. How they cooked, slept, worked, showered and shaved, what they did for relaxation—all these became important to the readers of the Sunday supplements and the magazines. Ironman's three astronauts were giving the world

a superb demonstration of a future in which space served them every day, and how they could get back a measurable return for their dollar. A future that had suddenly appeared in the midst of the everyday world . . .

And then there had come the not entirely unexpected deterioration in everyday performance. The doctors didn't know if the accumulated effects of weightlessness, or confinement, or radiation, or combinations of them all, had gotten to Buzz Lloyd. But the daily medical tests showed alarming tendencies, and when experiments began to go awry, then men on earth knew that a serious error by Lloyd could disrupt the life-support system and bring disaster to what had been a smashing success. Charles Keith ordered them home and they still had everything going for them, success all the way, because spending the entire year in space wasn't as necessary as proving the whole idea would work, and future ships would have twenty and fifty and even a hundred men, and you could send some of them home without disturbing a thing.

The bottom fell out when Ironman was ready to start reentry. The big engine would not fire. Nothing they did would make it fire and nothing they did told them what was wrong. Only that the oxygen of three men was limited and that they were going to die . . .

Pruett emerged from the cocoon of his mind, from the reflections into which he had moved with such ease. The present came back to him and he realized sharply where he was and he started thinking of the immediate moments.

Pruett computed his time with a yardstick no man in space before himself, Buzz and Stoney—American or Russian—had ever found necessary to employ: hours, minutes and seconds remaining until the last invisible wisps of oxygen hissed from the tanks and were sucked into their lungs. Then the percentage of carbon dioxide and water vapor would begin to increase. The foul mixture would crowd and shove within their bodies, in the limited volume of their habitat, in their suits if they donned them, in the cabin itself if they remained free of the pressure garments.

Pruett's knowledge of the processes of life now was as much a curse as it had once been a blessing, for he knew only too well what would happen when the mixture of gases billowed through his lungs, and the warm and moist alveolar walls struggled with sad biological futility to find the oxygen

for which his bloodstream waited—and for which his brain would very quickly starve.

Idly he wondered which one of the three would be the first to die. He pushed the thought from his mind. It was not only depressing, it contributed nothing to the moment. It hardly mattered. The difference would be measured either in seconds or in minutes, and the end would come while they were unconscious.

The knowledge of his certain death no longer evoked the tendrils of panic that had twisted and writhed for release when he first realized the inevitable outcome. He could, he knew, end it quickly and painlessly. He could lower the flow of oxygen, reduce the cabin pressure until, before long, his brain succumbed to the effects of hypoxia. It would come with delusions, and a strange feeling, strangely similar to that of a mild drunk, that everything was wonderful. He would slide, slowly and without a pang of remorse or fear, into unconsciousness. And while his oxygen-starved brain continued to fail, cells dying like rows of wheat falling beneath a scythe, he would sleep his way into the eternal sleep of death. He knew that this could be done, that it required only the twisting of one or two dials; and knowing this, he knew also he could not do it. He would not kill himself, and he would and could not kill his two friends. The idea of going out with this quiet whimper while they were alive and not suffering and in charge of their faculties was horribly repugnant to him.

And there was still the chance, no matter how remote it had become, that *something* might happen.

Pruett no longer believed that the miracle would be found in time, or that there might be successive miracles, to save their lives. But anything was possible. Not probable, perhaps, but possible. While he had accepted without struggle or remorse the inevitability of his death, and those of his men, he was not about to yield a single second of the time remaining either to him or to Buzz and Stoney.

Now they had completed the task given to them from Houston. They had reviewed everything there was to review and all they could come up with was a big fat blank. It was almost funny, thought Pruett; the service module propulsion system worked perfectly on the way into space, checked out perfectly during its periodic inspections while they were in the space lab, and then conked out during the last few minutes of a six-month tenure in orbit.

The human body, mused Pruett, is an engine. It's a mechanical device that requires certain metabolic supplies, just as any combustion engine requires those same supplies to produce the heat that men tap for power. It had long before been neatly worked out.

If you weighed 180 pounds, as he did (Buzz weighed 192 and Stoney 167, so that evened out pretty close for the three of them), then your body demanded just over two pounds of oxygen per day. A normal, healthy man needed along with these two pounds of gaseous fuel a total of five pounds of water and one pound of solid fuel. Every twenty days, one man—his body, rather—would consume nearly his own weight in fuel. Actually, he needed less than normal; weightless, free of running, walking, working, his fuel requirements were less than his needs on the surface of his planet, which now seemed a billion miles away.

Disregarding the small fractions and percentages, he knew that in response to his intake, his body would yield every day about two pounds of carbon dioxide and water vapor, some six pounds of water, and a small amount of solids, urea, and minerals. That meant a daily yield for all three of them of eighteen pounds, just matching the input.

All this, he thought distastefully, was quite academic and useless. All that mattered, since they had plenty of water from the fuel cells, and more than enough food to last them for weeks, was oxygen—or six pounds daily for all three. This they did *not* have.

Theirs was a need never imagined by the castaway, no matter how fierce and hostile the desert within which he might be marooned. For Pruett, Lloyd and Stone had most of the ingredients that men invariably need in a struggle to survive. They, in turn, had all the air necessary to sustain a population of billions, which the earth supplied so freely in its deep, heaving atmospheric ocean.

Pruett pictured the oxygen supply system in his mind (knowing all the time that Stoney had done this same thing in meticulous detail), searching for the impossible possibility that perhaps they might find some means of stretching out that oxygen supply. They could, of course, don their suits and helmets to restrict the intake of oxygen, reducing the flow to the absolute minimum. The oxygen would flow into the pressure suit of each man through a trilock adapter, flow along the suit's arterial network to arms and legs, fulfilling a dual purpose by cooling the limbs before moving to the helmet for

breathing. A man's exhaled air, heavy in carbon dioxide and water vapor, exhausted from his body through a helmet vent. The discarded air then flowed into the spacecraft/service module's environmental system, running the gauntlet of filters and coolers.

Strangely, the system of Ironman reverted back to the older environmental systems of former spacecraft. Because the command module would be in orbit for so long, cryogenic storage couldn't be used. They employed storage vessels for the expected time of flight between separating from the space lab and re-entering the atmosphere. There was a safety margin, of course, and it was this margin which right now was keeping them alive.

After the exhaled air vented from the pressure suit it flowed into the environmental control system—the old but reliable system—where it was made to run a gauntlet of filters and coolers. Here the system scrubbed out the carbon dioxide. Electric fans pushed the exhaled air so that it flowed across a bed of activated charcoal and several open containers of lithium hydroxide. By now that waste air already was greatly cleansed of its impurities; it was ready for the next step. The air flowed into a special exchanger which used nothing more exotic than water to remove from their bodies the excess heat—which had been transferred, during respiration, to the air. The process of heat removal was quite ingenious and was also a safety factor for the crew. As the heat was removed, condensing droplets of water were soaked up by a sponge. Every twenty minutes a small metal piston squeezed the sponge dry of its liquid burden. As the water drained off it was sucked into a collection tank. While all this went on, the excess heat vented outboard from the spacecraft as steam and instantly, in vacuum, was transferred into the white-green iceflakes that drifted from Ironman.

For their mission, the system had been modified from other Apollos, supplementary in a sense to not using cryogenic storage for their oxygen supply. Engineers reasoned that with the length of time the ship was to remain in orbit, there could easily be a breakdown of the fuel cell system in the service module. Simplicity was the key to equipment operation after a long period of nonuse, and the engineers reverted to the old Mercury system, modifying it for emergency systems within Ironman. Thus if their regular water supply ran short and they were in the command module longer than anticipated after separating from the S-IVB (how right they had turned

out to be!), then they would be able to utilize the liquid by-products of their respiratory processes and perspiration by drawing upon the collection tank. It was a beautiful and simple system for an emergency but, Pruett noted wryly, in this particular respect they didn't have that emergency.

The environmental control system wasn't yet done with their exhaled gases, and it continued the process of scrubbing and cleansing. Special filters strained out their more unpleasant and noticeable body odors and whatever dust-sized debris had clogged the air. Only after all this had been done was the air considered sufficiently cleansed and purified to re-enter the suit inlets and to repeat the process of cooling the heat from their bodies, beginning the cycle anew.

It was all very neat—goddamnit!—*too* efficient. Pruett could see nothing in the system or in its operation that would permit of any modification or action on their part that would aid them.

Pruett flicked the switches to feed power into the communications system. In a few minutes they'd be within direct range of Houston. They'd been told that mission control would have "specific data" when they made that contact.

Despite his own instinctive caution his heart pounded faster. He glanced at Buzz and Stoney and they returned his glance in silence. Pruett turned back to his own thoughts. Was it possible that Houston *had* found something for them? Could they have reached deeply into their grab bag of technological miracles and come up with the neat little package that would mean life for them?

"*You're just dreaming, space cadet,*" a voice said, and he winced as he recognized his own practical, sarcastic self.

Chapter XII

Deep in the steel bellies of the ships, in its greyhound destroyers and the aircraft carrier loaded with helicopters, the primary vessels of the recovery force for Ironman One, energy pulsed at its minimum. The force cruised slowly, a pattern of shapes painting soft wakes on the ocean surface, its mission to recover three men from the sea postponed now, possibly to be aborted forever. The men of this recovery force were veterans in their tasks. They had picked men from the sea who returned not only from earth orbit but from the moon as well. They wanted desperately to do the same for three men named Pruett, Lloyd and Stone, and they were fearful this might never happen now.

It was, in the rippling reflections of the moon, a fleet of frustration, of helplessness, of thousands of men sick inside themselves, grim, some bitter, others angry, still others wishing and hoping that crying might help . . . but whatever their play of emotion, for each man it was his own brand of compassion.

There is among the vessels of the recovery force a fierce and vibrant competition. This is the world's greatest sweepstakes—to snatch from the liquid sea the men returned from that alien environment beyond the ocean of air. It is fierce and proud competition, and when the great moment came, the men would crowd and jostle on the decks, anxious to be first to see the telltale swath of contrail as the superheated spacecraft hissed and plunged earthward, and the small

drogue parachutes came out, and then, two miles high, the great red-and-white canopies blossomed . . .

When men came home from their voyage "out there," and the men crowded onto the decks raised their heads and pointed with their fingers, the shout was one that could be heard across the waves, that rolled in throated thunder from vessel to vessel, and swept up in its emotional tides the wonder and joy of it all.

Except that the tides of emotion now brooded and sulked in the dark corners of despair that each man felt in his own helplessness. The decision had been made—the recovery fleet will stay, turning its vast, slow and rhythmic circle, the procession of frustration. Where was there to go? Who could leave?

They would stay—until the last breath of cool oxygen had been consumed, and the men in their thoughts strangled and drowned just as much as any of them would strangle and choke to death were they rammed deep into the world of inner space beneath the heaving steel flanks of the ships.

They cast their moon-bathed silhouettes on the water, and the men stared moodily at the swirling green phosphorescence pulsing on the sides and behind the metal shapes. On the long deck of the carrier, the rotor-winged shapes hulked in their impotence, and the carrier superstructure pushed up from the sea like a monstrous squid trapped and chained by gravity.

The three men far above them were dying. And each one of the men in the recovery force seemed to feel, in some degree, the weight of death pressing in upon himself.

Snap!

Charles Keith looked down in surprise as the pencil halves jutted awkwardly in his fingers. Annoyed, he flung them away.

Behind him, tired and drawn men in shirtsleeves and with stubble on their faces evinced no surprise at this action of the usually imperturbable director of manned space flight. In effect, Keith had assumed the role of mission control director. He didn't completely push Paul DeGrote out of the way, but he had assumed the mantle of responsibility in the control room. In the shocked aftermath of the retrofire failure of Ironman One, Keith had functioned as a bedrock of strength, in full command of his emotions, cold and efficient, and a

whipsaw to any man in the Mission Control Center who moved so much as an inch out of line.

Three men would die unless Keith and the men who worked with and for him could pull a miracle from the failure that was both unprecedented and completely baffling to them. And time was running out. Time . . .

The word had spread that Charles Keith had written off the crew of Ironman One. The fight between Keith and Ted Dougherty was already common knowledge. The fact that Dougherty had pounded the table and cursed and shouted for a rescue mission was well known; as was Keith's reaction that rescue was impossible in the time available to them.

Now the rumor was spreading that there *would* be a rescue mission. But Keith hadn't said anything. Maybe he was still chewing over the possibilities.

Charles Keith looked at the large wall clock, the red second hand turning inexorably, a pointer of failure and condemnation—at no one in particular and yet at all of them—here in mission control, at KSC where the service module had received its final checks, at the astronauts who maneuvered the machine in space, at the manufacturer, at the quality control inspectors, at everyone and everything. It didn't matter that until the retro failure almost everything about this mission had been perfect; it was that tiny, insignificant thing that wasn't perfect that could kill.

Like a long drop through the air without a parachute, Keith reflected. The fall never hurt you. What killed man was that sudden stop.

What was going to kill Pruett, Lloyd and Stone was something tiny, unseen, unknown . . .

Unless, unless we can pull off the impossible—unless we can violate every rule in the business with a rescue shot. Dougherty is out of his mind and the President is just as crazy to think they can pull off this stunt. Yet, he confessed to himself, crazy men have succeeded where the sane and careful even feared to tread. And right at that moment, Ike Saddler and Ted Dougherty and a small army were working frantically to pull the miracle out of the silk hat of impossibilities . . .

Soon he would be talking directly to Ironman. Keith knew he'd have to tell Pruett and the others that they hadn't found any answer. Oh, sure, they knew that everyone was looking for the needle in the haystack; no one had to tell the three men high above them that they were going without sleep and

whipping themselves on, that there were curses of self-recrimination . . . What the hell good would saying this do the men stranded in orbit? They knew it; that was enough.

Charles Keith looked slowly around the mission control room, the heart and soul of the long orbital mission, the nerve center on the planet for the machinery and the men who had rushed overhead these long months. Every man within sight of Keith in the sprawling room where men and electronics merged in a strange and marvelous partnership . . . every man here, he knew, felt as he did—trapped, helpless, infuriated at his inability to help the men who need them and counted upon them, and . . .

That's not altogether true, Keith chided himself. *You know Jim Pruett better than that. He may not like it, he may be—and certainly should be—damned unhappy about all of this, but he's not going to brood about miracles. Neither will Stone. You don't know about Buzz Lloyd because he's already started to crack. But Pruett? He'll count on all of us until the last brain cell winks out, and he'll buy the farm without a single thought that any man here would be ashamed to know . . .*

Keith sat in the center of the Mission Control room, toward the rear. To his left was the recovery operations director, a man with a white face and a feeling of stupid helplessness because he had thousands of men and dozens of ships and planes under his control and he couldn't do a damn thing with them. Keith looked at all the men, the flight director, the network status monitor, telemetry monitor, support control coordinator, flight surgeon, spacecraft environment monitor, CapCom, and the spacecraft systems monitor (and didn't *that* poor bastard feel, and look, miserable).

Keith moved his gaze slowly about the room. Along the right wall were the flight dynamics officer and the retrofire controller; the latter had been in constant touch with anybody—and by anybody he meant only the skilled and knowledgeable—who might know anything that would provide even a clue to the engine systems failure in Ironman One.

Before the latter two men spread a display of flight recorders. Here in the technical jargon of the computers and the engineers could be found the end-of-the-mission story—items such as the inertial flight path angle juggled against the velocity ratio. It also plotted the orbital path as altitude above a spherical (slightly bending the facts) earth, versus velocity. If you could read the language displayed and presented, you

saw unfolding the dilemma of three men. It was all there in the recorders—cross-range deviation and altitude versus range; orbital path as semimajor axis deviation and altitude versus ground elapsed time; judging from the moment of separation from the S-IVB, insertion velocity and longitudinal acceleration versus elapsed time and yaw error . . . hell. Keith closed his eyes for a moment and with his fingers kneaded the bridge of his nose. No matter how you sliced and dissected the technicalities, it all came down to the blunt but distressingly accurate words of the newscasters.

They're going to die unless these people in Mission Control, and all the other people with whom they're working and talking, can pull off the biggest miracle ever known in the space-flight business. *(And the newsmen were already writing the glowing eulogies and the obituaries; the television directors were frantically piecing together every scrap of film on the three men in Ironman; radio stations the country over were snipping and connecting tapes of their voices, and Keith hoped the police had cordoned off the homes of the astronauts, or that their folks had slipped away somewhere, because the army of pencils and pads would descend upon them like the plague. The whole thing saddened Keith, but nothing could be done about that. Keith had never heard of a man named Ed Lyons, who had shaped a kid named Pruett into a real pilot; nor did he know that at this same moment an enraged Lyons had pitched a loudmouthed reporter through his front window . . .)*

Stretching in front of the many controllers in their four tiers was a world map twelve feet high by nearly sixty feet wide. Along its multicolored and glowing surface wound the orbital paths of Ironman and the locations of all the world tracking and communications stations, ships and planes. Colored rings flashed with light whenever the spacecraft rushed to within range of a station's radar and radio beams, showing everyone in the center instantly, and at all times, where the capsule was in relationship to ground contact and tracking. The colors of individual rings indicated the operational status of each station, degrees of malfunction—but there was only one malfunction that mattered now, and it was in the spacecraft that this elaborate rigging pursued with its electronic eyes.

The failure that condemned three men was a wraith that danced just beyond their reach, just at the edge of their fingertips, and they couldn't touch it. But they had known be-

wildering problems before, much more complicated, sometimes in components even simpler than the propulsion system of Ironman, and they had whipped those problems through scientific sleuthing that staggered the imagination and defied all the odds, and carried every manned space flight of the country through to a successful conclusion with perfect safety . . . He stopped the thought sharply.

But it was all *true,* damn it! They had worked against and overcome problems that seemed impossible of solution within the time frames allotted them. They took absolutely nothing for granted—nothing, that is, except the inevitability of problems and troubles.

During the early days of Project Mercury, Keith recalled, when he, like everyone else, was still learning this business, there was one vital part of the Mercury capsule electrical power system that drove them wild. The system had passed every qualification test; it worked perfectly. Yet when it went into the capsule it failed. Again and again it failed, until the engineers started to look over their shoulders at all the eyes staring coldly at them. They subjected the system not only to every test known, but also to new ones they had to create themselves. And they found it—the trouble. There were certain components that no one knew were temperature-critical. When they were placed in the capsule, they failed. Taken out and tested—they worked. Put back into the capsule—failure!

A heat source in the spacecraft, close to the electrical system, was the problem. All they needed to do was to move the electrical system a bit, get it away from the direct heat, and it worked perfectly. But it was only one indication of the infinite range of possibilities that would create failures. And if it had happened in orbit *before* it took place in the test chamber—well, cliff-hanging was a part of this game.

Like now.

Could something in the electrical intricacies of the propulsion system have been installed improperly? So that it worked for a while and after six months of being alternately frozen and heated while in orbit, it suddenly quit? The engineers swore this was impossible with the propulsion system of the service module of Ironman. If they could stake *their* lives on it, Keith knew, they would gladly exchange places with Pruett, Lloyd and Stone, so certain were they of their systems. Of course, their willingness to do so didn't *help* the men in Ironman . . .

Keith thought of other "impossibilities" in systems that led

to disastrous failures. A great jet airliner had plunged into the unyielding earth because a little bolt, only three inches long, had been improperly mounted. But that small bolt (which by itself wasn't any great problem) jammed a servomotor, and the towering rudder slammed hard over. The silver giant rolled over on her back and rushed into an inverted, suicidal plunge. Do you rate this as a failure of the airplane itself? (*"Yes!" screamed the 114 dead voices.*)

Keith wracked his memory and again the technical horrors of the old Project Mercury crowded his thoughts. They had to learn the hard way in the early days. One of the things they learned was that you couldn't even use normal lubricants within their first space capsule. If you used oil—well, the fire would be spectacular. Mercury in flight had an atmosphere of one hundred per cent pure oxygen (and so did Gemini and so does Apollo), and pure oxygen and oil mean instant pyrotechnics.

So they used special lubricants (as we still do, thought Keith), and you *must* use them with exacting care. For a brief and ugly period in Schirra's mission, the third in the Mercury series, there was the chance they would have to abort the flight and bring Wally down prematurely. The temperature of his pressure suit kept rising despite all efforts at control, and only because Schirra was so swift and sharp in handling the system was it possible for him to bring down the temperature and wrap up that mission in the classic "textbook flight."

What caused the trouble? There were some red faces about *that* one. In the control system there was a sensitive valve. The checklist called for that valve to have just three drops of lubricant and no more. A zealous technician used something like six to ten drops—*drops,* mind you. But it was enough to contaminate the valve and nearly wreck the mission.

There didn't seem to be much question that the problem in Ironman One's SPS lay somewhere in the electrical system. Yet it was this system precisely that had received the greatest scrutiny and umpteenth-time checking. There had been electrical system problems in several Apollo missions but they'd all been hacked without any excessive sweat. There had been more in Gemini but even those, more troublesome, had been eliminated. Searching through the past of all the Apollo flights, the ten Gemini two-man flights, the four orbital flights of Mercury, it was, again, the one-man program that started this whole business that reminded Keith so

strongly of the "impossibility" of failures that somehow, despite all precautions, continued to happen and plague man's adventures beyond his planet. It was the electrical system of Mercury IX, the solo mission of Gordon Cooper, that drove the technical groups mad and put Gordo to the test of proving what a truly great pilot he was.

When the .05g panel light came on during Cooper's nineteenth orbit, everyone knew that real trouble had come storming into the mission. The long and short of it was that the activation of that light eliminated part of the automatic re-entry control programming and forced Gordo into manual control for retrofire *and* starting into re-entry. The *why* of that one caught them all by surprise.

Keith had been one of the investigation group. The trouble came in two connectors to an electrical amplifier—the amp cal. The two connectors were located in the amp cal where electrical signals of various spacecraft systems were converted into commands; the commands caused activation of the hydrogen peroxide thrusters in the automatic control system. It was a critical area; it could hardly have been more critical, Keith reflected.

They went after the source by examining Cooper's spacecraft with extraordinary and meticulous probing. They knew that the first evidence of failure had been the sudden appearance of the .05g panel light. But just as significant was the fact that, subsequently, there was failure of the AC power from the spacecraft inverter.

They traced the inverter trouble to the electrical power connector which, among other functions, passes the AC output from the inverter buss of the automatic control system into the amp cal. They discovered that the insulating qualities of the connector had failed. This permitted the AC power line to find a ground in the spacecraft and—short-circuit.

The inverters were designed *not* to operate in event of such a malfunction in the circuit. When this type of electrical fault occurred, the capsule automatically bypassed the sequence of events that were to take place with the faulty system. The engineers confirmed the working condition of the inverters—on the ground, hooked up to test equipment, they were perfect.

Then they discovered corrosion in and around another electrical connector, through which passed some of the circuit-

ry to the .05 signal light. But where the hell could this corrosion come from?

Moisture.

Moisture! *In space?*

Certainly. Why not?

There was a man inside that cabin. A man who drank water—and spilled some of it. A man who perspired, and whose perspiration, like the drinking water, drifted through the cabin in the form of quivering globules.

Several of these fascinating little spheres had drifted about and touched a connection on the electronic box that made up the amp cal.. The water globules spread over the equipment and corroded the connection. Very quickly the globules wiped out all automatic controls through much of the retro and re-entry sequences.

Because of a few, lousy, floating drops of water . . .

The Apollo command and service modules, linked together to form the machine known as Ironman One, drifted in attitude-free flight as it plunged weightlessly around its home planet. The men within the spacecraft had emerged from the inertia that seemed to have gripped them for hours. They had searched every aspect of the flight since disconnecting from the space laboratory in which they had lived and worked for nearly six months. They had studied and mentally probed and dissected and rebuilt, and they had only headaches for their reward. This could go on only so long and . . .

"Okay, Buzz. Goddamn if I don't think you're right."

Pruett's sudden outburst, coming after so long a silence of meditation, caught Lloyd and Stone by surprise. But there was a tone of decision in the commander's voice and they looked close by at Pruett, who gestured angrily as he went on.

"To hell with this waiting for a bunch of slide-rule jockeys. Nobody ever got anywhere sitting on his ass and waiting for the world to come to him. We're pilots. We used to fix airplanes with paper clips. You guys ready to try and fix this bird?"

"Man," Buzz Lloyd breathed, "don't wait to ask me again." A broad smile crossed his face as he started for the stowage compartments beneath his center couch. "I'll get the suits and backpacks."

Pruett nodded. "Right. Stoney, where do you want to try first?"

Keith lit a cigarette and . . .

"Charles! We have Ironman now." It was Spencer, on shift as CapCom.

But Keith had the sudden germ of an idea. "Spence, talk to them for a while. Get the full status report and anything they have to give us—*anything,* any ideas—on the failure. But whatever you do play it carefully. Don't get them riled up. If you have to, ask Stoney a couple of questions on the systems. That will keep them busy and—I'll be on in a few moments."

Keith stabbed a button on the control panel before him. Less than a minute later he had the man he wanted.

"Scotty? Yes, this is Keith. What? No, never mind that. I want to ask you something and I need fast answers. We've contact with Ironman now. No! Now, hear me out." He forced his words to come slower, to be clear the first time. "I want to ask you about the attitude-safety switch. You know, the new safety-interrupt for retrosequence and fire. Let me review it quickly and correct me if I'm wrong. The system is so set up as to block firing of the SPS engine during retrosequence if the spacecraft fails to hold the proper retrofire attitude. Right?

"Good so far. Now, is it possible that there could be a snarl between the gyro sensors and the safety switch?

"What? No, no! If he brings the spacecraft to proper attitude, but there's an error in the *sensing* system, it is possible this could block firing of the SPS? Even if they hold it right on the nose, the sensors can misinterpret the attitude. Think of how long those damn things have been up there. Can this happen?

"It *is* possible?"

"No, hold on a moment."

They had installed the safety device after a harrowing incident with an earlier Apollo flight. Parker had commanded that mission. With incorrect yaw attitude-hold as he fired the SPS for retrothrust, the Apollo lost the effectiveness of some of that energy; the force was at an angle to the flight path. The spaceship made a perfect re-entry—and splashed down four hundred miles from the planned area. So they put in the safety. Gyro sensors would note the exact attitude through pitch and yaw of the spacecraft. If the attitude wasn't right

on the button through these two axes, the sensors would block the electrical current to fire the SPS engine and—the engine would *not* fire.

But what if something were wrong *with the sensors themselves?* What if they weren't functioning properly, or they had jammed the circuit? It *could* be the answer.

"Scotty? Suppose that this is the trouble. No, man, I know we're not certain! But it's the only lead we've had so far. Just *suppose* that this was it.

"If this is the case, can one or two of the people in Ironman check out the sensor system?

"I know that, Scotty. But if this is the answer, can Pruett or Stone get to the system itself, the wiring? Can they bypass the sensors, eliminate the safety switching?"

The answer took less than a minute. Scotty was still talking when, with infinite sadness, Keith cut the line.

It was possible, the engineer admitted. It was possible that this might be one of a hundred things. It was also *possible* for Pruett—Stone would be best for this, Keith knew—to get to the wires, but so implausible and impractical as to bring the odds of success to astronomical figures. And even then, it was only one chance in—what? Scotty had said one in a million, and even that might be optimistic.

Scotty was right, Keith knew. It was extremely difficult to get to the wiring system even when the service module was on the ground and rigged up to its inspection stand. It was a maze of tanks and plumbing and wiring and other equipment. You had to get in deep, because the wiring was so well portected against the extremes of its working environment. And you needed help, and you had to have the right tools, and all the proper working conditions.

The crew of Ironman had EVA capability. They could go outside, get to the service module. They could open the inspection panels. But then what? Could they get into the module, trace down the wires, check them out, find the fault if there was a fault in the system, and bypass it or correct it? With pressure suit gloves?

"Sure, and I can fly to the moon in a canoe," Keith muttered to himself.

He looked up; Spencer was signaling frantically, pointing to the headset speaker and microphone. Keith slipped on the set; Pruett's voice came in loud and clear. Strange, his voice seemed to be stronger and more confident than the last time he'd heard him. Why? What had happened to bring on this

change? Keith switched to transceive and broke into the conversation.

"Jim, this is Charles Keith on the line."

"Roger. You got any good words for us?"

"Yes and no, Ironman. I—"

"Spill it quick, Charles. Time's awasting."

Keith glanced at the other men. He covered the mike. "Set up for video, fast," he barked. He removed his hand.

"Roger, Ironman. We have not yet been able to determine the cause of the malfunction. However, we've come up with—" He heard other voices, low. "Do you read, Ironman?"

"Yeah, we read. Nothing really new, is there? From what you say it's pretty hopeless, isn't it?"

Aside: *"Get that video! Something's going on up there!"*

"Negative, Jim. I repeat, that's negative."

"Don't tell us you got an ace up your sleeve. Fun and games aren't what we—"

"Listen to me, Ironman. This show isn't over yet, not by a long shot. Here's what we're going to do. We—"

At Keith's signal, Spencer broke into the exchange.

"Ironman, Spencer here. Sorry to interrupt but we'd like to check out some systems. Would you go automatic on the video monitor, please?"

"You want video now, for Christ's sake?" There was no mistaking the voice of Buzz Lloyd.

"Ah, that's affirmative, Ironman. We're set to receive your picture now."

"But what the hell for?" The exasperation in the voice was unmistakable.

They heard Pruett break in. Gently, fully aware of the explosive mood of the man in the spacecraft cabin with him. "No sweat, Buzz. If they want the video we'll give it to them. They must have their reasons. Stoney, would you—"

"Sure." Stone's voice. The TV scanner monitoring the cabin was activated. Individual monitoring screens in mission control came alive. Spencer switched on the large six-by-eight screen on the front wall of Mission Control. For several moments the picture was distorted and flickering. Then it came into focus. No one could miss what was happening within Ironman.

"Jesus, they're getting into their suits!"

"They're going EVA! They'll kill themselves for—"

Chapter XIII

"Knock it off in here!"

Spencer's voice whipped at them on local circuitry, cut out from the spacecraft-mission control line. Instantly the room went silent.

Thank God for that video scanner, Keith thought. He studied the men, their faces and actions. He knew he had to play this as carefully as he could.

If he carried this off, if he could do the right thing with the right words, then they would protest. He wanted them to do precisely that. They'd get rid of the bile gathering within themselves. They'd shout and throw questions and examine what he said and ridicule what he would promise them. They had to do that. And as fast as they brought up the questions he would have the answers ready for them. He'd pound back their objections with answers they could understand and appreciate and, more important, that they would accept.

He knew the Ironman crew had run out of patience up there and he had to give it back to them.

"Ironman, Keith here."

"Yeah, go ahead."

"We're coming up to get you, Ironman. We're—"

"They're going to do *what?*" Lloyd again. He wasn't buying anything Mission Control had to say. Damn, he could be real trouble before they were through this thing.

"Let him finish, Buzz," Pruett ordered.

"We're coming up to get you," Keith repeated. "We will

launch a rescue mission from KSC. We'll launch in just over forty hours from now so that we can work in a first-orbit rendezvous. This will fit within the level of oxygen you have remaining on board. Got that?"

"Sure, we got it," Stone broke in for the reply. "Who's flying this magic carpet mission?"

"Ted Dougherty is the pilot."

Pruett got in first. "What are you using for hardware, Charles? We know that you haven't got a—"

"The launch vehicle will be a Titan IIIC. At this moment assembly of the booster has started at Pad 41 on the Cape. More specifically," Keith was drilling home the facts now, "the vehicle core is already assembled in the VIB. The last shipment of solid-propellant stacks at this moment is airborne via Charley One Forty One to the skid strip. It will be at the pad less than three hours from now. Do you copy?"

"Sure, we copy," Lloyd said with open sarcasm. "Jim, who they trying to kid? Forty hours! Christ, that's a laugh. *I'd* laugh if it were any funnier. That's the biggest crock of—"

Stone broke in. "That's all very interesting, Flight, but what are you using for a spacecraft? The Apollo CM won't—"

"The spacecraft is an X-RV lifting body."

"But that's a two-man ship!" Lloyd shouted.

Jim Pruett had flown some of the preliminary tests on that bird in the old X-24A program. "Charles, Buzz is right. It's a two-man vehicle and—"

"Modifications to accommodate four occupants are just about completed. The X-RV will handle a pilot and three passengers. I'm talking about you people."

"But the damn thing has never made a boost flight! It's never been in orbit bef—"

"We have full confidence in the spacecraft."

"Well, that's dandy," Pruett said, heat showing in his voice. "Hero Dougherty, huh? Don't crap us, Keith." The anger was growing. "I happen to know it's a two-man ship and I also know that Dougherty has never flown that thing. Furthermore, I—"

"We're bypassing the manual malfunction detection system," Keith said, steeling his tone. "Cape control will monitor the entire boost phase until out of atmosphere for any malfunction and necessary abort. The pilot will be relieved of

that responsibility. Dougherty will fly a one-man spacecraft." *I hope*, Keith said fervently to himself.

"Don't you hear well? He's never flown that thing before. He can't—"

This was the way he wanted it, Keith told himself. The questions and the answers.

"He can and he will," Keith snapped. "I'll remind you that you never flew the Apollo before your mission. Or that there has always been a first time for every new spacecraft. And aircraft. Dougherty is right now in the X-RV simulator. We have full confidence in his ability to master the systems and to carry out the rendezvous. We have already installed a solid-state digital computer in the vehicle which will be linked directly to control here in Houston. All tracking requirements will be met before the scheduled launch. Now, I have work to do. I've got a rescue mission to ride herd on. Keith out."

He cut his switch before anyone in Ironman could come back with another word. Keith handed his mike and headset to Richard Wheeler, the on-duty flight director. "You take it. Knock down their arguments as fast as they bring them up. And *don't* let them go EVA, damnit."

Wheeler studied his superior and then nodded. He slipped on the headset and boom mike and took a seat alongside the CapCom console.

"Ironman, Flight here. This is Wheeler. We'd like to discuss with you—"

"Never mind the discussions," Pruett snapped. "Let's get rid of the fairy tales and get down to cases. You copy?"

"Roger, Jim. Got you loud and clear. We—"

"Where the hell is Keith?"

"He took off, Ironman. Like the man said, he's got things to do. He's on his way to the Cape right now, in fact."

"Listen to me, Wheeler. You people can't get the damn thing ready for launch in forty hours! I know that equipment as well as any of you down there. Buzz and Stoney feel the same way I do. It's a shot in the dark that hasn't got a chance of working. We're better off trying to—"

"Ironman, the opinion here is that we can pull off this mission. It means going without sleep for a while, but—"

"Shove your damn opinion! You haven't got time and Dougherty won't be ready to fly that slab-sided son of a bitch for a month. You're only going to kill Ted, goddamnit. He's not ready to handle that ship. It's a full job for two men and

you all know it as well as we do. Of all the harebrained, knuckle-skulled, idiotic—"

"What are we waiting for? Let's get the show on the road."

Buzz Lloyd again, this time more persistent, hardening his decision. The way Pruett was talking, the men in Mission Control knew those people were going outside Ironman, and that would wipe out the last slim chance they had.

Pruett came on again. "Flight, we've decided to make our move up here. We've thought it over from every possible angle. Just lying here and stewing in our juices isn't our idea of the best way to—to, well, to end this mission."

Wheeler walked on eggshells. "We copy, Ironman. Would you tell us your plans?"

"Right. We're going EVA and get into a position where we can eyeball the engine. The fuel valves could be frozen for all we know. We'll pull the insulating hatches and if we confirm our hunch, we'll swing the ship around and hold it with the sun on them. We'll—"

Wheeler heard Paul DeGrote cursing beneath his breath. "Hell, that won't do them a damn bit of good," he said, covering his mike. "They haven't got the tools to work on anything up there. They could do more harm than—"

Dr. Kortney sat on the side with a sardonic smile on his face. "Sure, tell them something like that," he said to DeGrote. "You just tell those three men that whatever they do is worse than what they've got on their hands now."

DeGrote spun around, his face contorted. "You're goddamned right they can make it worse!" he said, his anger making his voice a hiss. "Goddamn you, Kortney, *think*. They've got a chance with the rescue attempt. A chance, if nothing else. But if they go EVA and screw around out there, they're blowing the last thread of hope. You know what they'll do to their oxygen cons—"

Kortney put up his hand. "Forgive me. I wasn't thinking. Of course; you're right."

DeGrote's anger vanished as quickly as it appeared. They were all under pressure. While they argued, Wheeler was still talking with Ironman, still trying to keep the crew calm, still trying to keep the fuse from going off.

"Ah, that's an interesting thought, Ironman," Wheeler said. He was calm, polite, his voice soothing but not overly so. "But we'd, ah, like to remind you that we're still getting complete TM from your systems and we have no indication

of any lines being frozen, or anything else you might be able to correct by a hit-or-miss operation. Jim, believe me that I'm on the level. We really believe the rescue mission is it."

No answer for the moment. The astronauts were talking with one another inside their cabin, their radio transmitters turned off. But there was no mistaking Lloyd's attitude and you didn't have to be that good a lip reader to *see* what he was saying.

"Jim, goddamn them, they're playing footsy with us. Tell 'em to shove it. You want to just lie here and die like an animal!"

They saw Pruett switch to transmit. Quickly Wheeler spoke before Pruett had the chance.

"Ah, Ironman, we're starting to lose you. Would you guys stand by one while we patch into world net? Over."

There wasn't much else they could do. Otherwise they had no way of knowing if Mission Control had heard them.

"Yeah. We'll hold."

Dr. Kortney was scribbling furiously on a pad. Several engineers surrounded him. The group talked quickly and in low tones. DeGrote, looking over Kortney's shoulder, motioned Wheeler to pick it up with Ironman One.

"Okay, Ironman. We're patched in. You copy?"

"Fine, Flight. Look, we appreciate what you're saying and all—and what you're trying to do," Pruett said. "But we're all agreed here that we've got to do something besides lying on our asses. Nobody ever got anywhere like that. Stoney knows the SM systems inside and out. We all agree we've got to take affirmative action on our own."

They were still fitting on their suits.

DeGrote leaned forward to get closer to Wheeler. "Make it an order," DeGrote said. "Order them not to go outside. No EVA. They're to stay in the ship."

Kortney broke in. "And what if they tell you to go to hell? Do you realize their condition? They're—"

"Then what the hell good is an order!" DeGrote cried.

"No good at all," Kortney said quietly. "That isn't the way with these men. They feel they're already dead, and—"

Wheeler wasn't waiting any longer. He wished to hell Keith was still here. He took a deep breath. "Ironman, we appreciate and we understand your desire to get that steamboat fixed. And we might do the same thing if we were in your shoes. But we need your cooperation if the rescue mis-

sion is to succeed. Otherwise you're tying us up and killing your chances."

"Say again, Flight?" That was Stone. Wheeler was glad Stoney was getting into the picture. They were going to talk systems now and that meant they needed his attention. Stoney was as cold-blooded and impartial as they come when the subject was machinery and equipment. Wheeler was counting on that. He looked up at the screen. Pruett and Lloyd had their eyes on Stone. Buzz fidgeted impatiently but was waved to silence by Pruett.

"Stoney, the critical factor is your oxygen supply—"

"Listen to the son of a bitch," Lloyd rasped. "*He's* telling *us* about—"

"Shut up." Pruett there. Lloyd looked at him in open astonishment but remained quiet.

Wheeler had the notes from DeGrote and Kortney. Other astronauts were standing by as were engineers and troubleshoots, instantly ready to supply whatever information Wheeler as flight director needed. Spencer, the current shift CapCom, had used the break to gather in the best brains available. The team that had flown so many men in space, and in four different types of spacecraft—Mercury, Gemini, Apollo and the lunar module—was once again working perfectly.

"Ironman," Wheeler said slowly, knowing that Pruett and Stone especially would be listening and weighing the wisdom of what they would hear, "to get fifteen minutes of activity outside the spacecraft you're going to have to make a trade-off. Those fifteen minutes have got to be paid for. It's going to cost you people a minimum of three to four hours of passive breathing. Now, from where we sit, you don't have that oxygen to spare. And you know even better than we do that fifteen minutes isn't long enough to really do anything. You've got to get suited up, set up the systems on standby, right?" Wheeler kept talking. "You'll have to dump whatever air there is in the cabin right now and that's another loss. Then by the time you're out of the ship and around the side of the SM means another five to ten minutes. And you have no way of knowing whether the insulating panels are frozen themselves or jammed tight, and that means more time. It'll take you a while to set up reaction braces so you can work under zero-g. If you people are out there for an hour it's the same thing as twelve to eighteen hours of passive oh two con-

sumption, and the chances of finding anything are minimal, and doing less about it is the real problem."

They watched Pruett and Stone looking at one another. Stone's head moved slightly in a gesture that signified his agreement. Buzz Lloyd was a mixture of seething anger and bewilderment. Small, jerking motions of his hands brought a quiet, "Oh, God," from Dr. Kortney.

"We'd like to suggest," Wheeler continued, "that in view of the balls-out effort on the rescue mission, you do what you can to give those people the maximum possible time in which to reach you. We are, therefore, making this specific recommendation, and we'd sure like you to think it over. We recommend you go into lowtide mode. Reduce the cabin oh two pressure to three point five p.s.i., and execute a full emergency powerdown."

Lloyd's voice snarled into the headsets. "That's great. They want us to buy it in our sleep. Nothing messy. They—"

"Did you copy, Ironman?"

"Yeah, Flight. We're thinking about it."

Silence hung heavy in the spacecraft cabin as Pruett and Stone digested what they had heard. No one in Mission Control spoke a word as they saw Lloyd move suddenly, angrily. Bracing himself with one hand, he shoved Pruett's helmet before the astronaut.

"We got these things out to use 'em, remember?" Lloyd said. "To save our lives. To do whatever we could instead of dying here like animals in a cage. Damnit, tell 'em to shove it, Jim!"

"Ironman, Charles Keith here. You copy?"

"Keith? They told us he was on his way to the Cape." Lloyd; puzzled and then the anger again. "I told you they were lying to us, Jim! They said he was flying to the Cape and he's right there with them! All this time they've—"

Pruett broke in hastily. "Charles, Ironman here." Pruett hesitated, anxious not to jump to any hasty conclusions. "What's the story?"

Keith, who had listened to the outburst from Lloyd, and who was well aware of the psychological instability of the man, paid no overt heed to his words. Instead he responded to Pruett as if he had been the only astronaut to speak.

"Ironman, I'm patched in to the world net through an ARIA aircraft. I—"

Pruett pictured the great Boeing JC-135 with the fuselage

packed from nose to tail with Apollo tracking and communications equipment. What was Keith doing in— "Charles, say again your last transmission?"

"Ironman, that is a Boeing ARIA aircraft. Right now we're leveling off in our climbout from Ellington. The airplane was kept waiting for me at the field. We're en route direct to the Cape. I broke in to let you know that the rescue mission is now ahead of schedule. The solid motor segments for the Titan arrived several hours ahead of time. Right now General Parker is with me. You know Colonel Saddler, don't you?"

"Ike Saddler? Sure, he used to work out at the static stands at Edwards. Is he in on this also?"

In the video monitor aboard the ARIA and at Mission Control in Houston, men breathed a bit easier as they saw that Pruett was no longer completing the donning of his pressure suit. Clayton Stone also had stopped in mid-suiting. Only Lloyd was fully clothed in his pressure garment. *Christ*, Keith breathed. *We're getting a break at long last.*

"Ironman, this is General Parker." The general didn't stop to identify himself. He had once been Pruett's commanding officer. "This message is for all three of you. To answer your question first, yes, Ike Saddler is in on this all the way. He's got complete charge of getting the Titan IIIC ready to go and I don't need to tell you that there isn't anyone in this business who could do it better or faster than Saddler. You agree?"

"No argument about Saddler, General," Pruett said.

"Good. I won't take up any more of your time then. I'm with Mr. Keith and we'll be together all the way. My job in this is to cut all red tape and I mean *all*. That's my authorization from the JCS. I'm telling this to you so that you'll know we're doing everything humanly possible and just a bit more than that. Parker out."

Good. The general did just what I wanted him to do. In with his two cents' worth, get the impact in there, and then out of the picture. Good man, Parker . . .

"Pruett, Keith here again. I thought you'd like to know that right now Ted Dougherty is working with the X-RV simulator and that part of the operation is coming along well." *I'm a liar*, Keith admitted to himself, because Dougherty was having fits with the controls simulator, *but this is one time where I'm justified, if I can keep those people calm and willing to stay put . . .* "The spacecraft will be delivered either tonight or first thing in the morning, and by delivery I mean we're bringing it in by chopper straight to the pad. The

Range is cleared, we're set for direct link between NASA and Air Force for tracking and mission control. That's it for the moment. Now I'd like you to do something for me."

"All right," Pruett said heavily. "Try us."

"We're getting this rescue shot ready to go. Get out of your suits, do what Kortney tells you to do, and go to sleep."

Dozens of eyes studied the video monitors that showed the face of Jim Pruett. An interplay of emotion was evident in his features. He glanced at the other two astronauts with him in the spacecraft, nodded to himself, and spoke in a deceptively calm voice.

"Can you get us down, Boss?"

Charles Keith didn't hesitate an instant.

"We have a better chance than you do."

They watched Buzz Lloyd snap off his radio link. His face was contorted with fury. "He's lying!"

"Buzz." Just the name. Lloyd turned to face Stone. "Buzz," his fellow astronaut said quietly, "you use up twenty, maybe thirty per cent more oxygen when you get excited like that."

Lloyd couldn't find his voice.

"C'mon, fella, don't fight it so hard. We're doing this together," Stone said.

Pruett came on open line to Houston and to Charles Keith in the Boeing even then rushing to Cape Kennedy at more than six hundred miles an hour. "All right, Charles. We'll play it your way."

Keith knew when it was time for him to get out of the way. From here on this was hardware and no longer personality. "It's the best way. The only way," Keith said. "I'll keep you informed directly of status. Flight?"

"Yes, sir," Wheeler came back at once.

"Take over," Keith directed, and switched off. He kept the receiver open. Keith and General Parker studied the screen and listened to the exchange. Maybe it would just work . . .

"Ironman, this is Dr. Kortney."

"Hi, you old pill-crusher," Stone quipped. The men in Mission Control exchanged significant glances. That crew up there was a long way from being counted out . . .

"And the same to you," Kortney said, consciously keeping his tone mellow, his words more in the nature of suggestions than of orders. "Let's get down to business. We're all agreed that the essential requirement now is to extend your oxygen supplies."

"Hooray," Lloyd said. "They finally arrived at a decision down there."

Kortney was delighted with Lloyd's reaction. It was the first time in hours he'd spoken directly with the ground, and the sarcasm this time was precisely that, not bitterness or hatred.

"That goes for you too, Buzz," Kortney came back with a laugh. "There's even a rumor going on down here that you breathe oh two like regular people."

"Send me a couple of bottles and I'll breathe the damn stuff forever," Lloyd said.

"That's the whole idea," Kortney replied. "Let's cut the mustard, Ironman. The key is to stop all exercise and to reduce physical movement to its absolute minimum. Not only that but you've even got to cut down on your talking. So be sure and keep quiet while I'm reviewing this with you. Like I said, no exercise, no movement. Keep quiet. You've got to pay attention to your breathing. Slow and shallow. Got that? Slow and shallow breathing. Every gesture, every word, every emotion means energy burning inside you and you can't burn energy without burning your oxygen. We can get a considerable increase in your useful oh two supply if you'll follow these instructions—"

For several moments no one spoke. What the people on the ground saw visually told them a thousand times more than words might describe. Pruett and Stone were already free of their pressure suits and were rolling them neatly for stowage beneath their couches. Almost out of the picture, but partially visible, was Lloyd. He was just removing his pressure suit and following the others in preparing it for stowage. He wasn't happy about it but he was cooperating and that's all that counted. Stone was the first to complete his task. Wearing his lightweight jumpsuit, he was pushing his weightless body back to his couch on the far right side of the command module.

"All right," Kortney continued. "Now we can get to some specific instructions. As soon as you're settled, open the drug kit. The drugs are marked clearly. As soon as you complete the powerdown schedule, take one—that's one—tablet of stryazine. You're to take one tablet after every meal. Drink as much water as you want. In fact, the more the better. Got that?"

"Roger," Pruett said.

Pruett was already on his couch, strapping in. Buzz Lloyd moved clumsily into the video frame, his body in between a float and a crawl as he eased himself down to his couch and

strapped in. Stone reached out with his right hand for a blue-covered manual snapped into its bulkhead receptacle. Lloyd kept busy with his straps, wasted motions that seemed to keep him satisfied for the moment. Pruett lay back, his head moving slowly from left to right as he scanned the instrument and control panels. There were hundreds of switches, dials, gauges and lights to be covered.

"Let's do it," Pruett said, the words a commitment for all three men.

One by one, as Stone called out the sequence of events, panel lights faded. Other glass eyes, glowing brightly, winked out. The needles of gauge indicators moved to new positions, some to zero readings. It was a ritual of removing life from the machine . . .

"CMC attitude switches to IMU," Stone called in a flat, mechanical voice.

Pruett confirmed the command and the movement verbally.

"CMC attitude switches to IMU."

"Manual attitude switches to rate command."

"Manual attitude switches to rate command."

"Limit cycle switch off."

"Limit cycle switch off."

"Direct RCS switch off . . .

"SCS indication power switch off . . .

"Fuel Cell One main buss A switch off . . .

"Fuel Cell Two main buss A switch off . . .

"Computer to standby . . ."

No response.

Pruett watched Lloyd with the alertness of a hawk. The computer, guidance and navigation system controls were directly before Buzz. Stone flicked his eyes to the left. His voice was steel.

"Computer to standby."

"Computer to standby." Pruett's voice, not that of Lloyd.

Buzz stared straight ahead, his face unmoving, his eyes vacant.

Pruett released a strap, reached over and across Lloyd and worked the switches. The computer lights went out. Pruett eased back to his couch.

"Go," he said.

Stone's pen was unmoving on the checklist. "Sorry. I heard no response with control movement."

Pruett stared at him. "Can't you see it's off?"

"Do it by the numbers," Stone came back immediately. His eyes were unblinking as he looked at his commander.

"Roger," Pruett said. "Computer to standby."

"Cockpit lights off," Stone called.

"Cockpit lights off."

Their faces vanished. Their eyes adjusted and they saw one another in shadowy light, pale multicolored glows from the remaining panel lights soft and barely discernible yet.

"El off."

More lights went out. Stone held a soft handlight over the manual.

"El off," Pruett called.

"Back panel lights off."

"Back panel lights off."

Stars could be seen through the windows. A pale glow drifted with them into the cabin of Ironman. A glow reflected upward from the planet below. The radio controls glowed dimly but clearly, but Pruett and Stone stared at the green light with the word *Retrofire* silhouetted clearly in the now bright glow. Pruett leaned forward again, peering intently at the signal. The *Retrofire* confirmation signal bathed his face in a pale green spray. Pruett nudged Buzz Lloyd.

"Why isn't that damn thing off?"

Lloyd shrugged. His manner, his reply made it all too clear he didn't care, that he had lapsed back into deep gloom. He refused to answer in words. Pruett sighed and pushed himself gently back to his couch.

"Flight, Ironman," Pruett called.

"Roger, Ironman. Go."

"We're all cranked down."

"TM confirms all systems powerdown, Ironman," Wheeler replied. "We'll check in when you come over the hill again. We're staying open on the world net so if you need us for anything just holler. And if there's any break in what we're looking for, we'll give you the word."

"Yeah, you do that little thing, Richard."

Wheeler recognized Stone's voice. "Righto, Stoney."

An awkward silence followed. Neither the men in their elaborate living coffin in space nor those in Mission Control were inclined to waste any further words. It went like that for twenty minutes.

A long-distance priority call came into Mission Control. Dr. Kortney was handed the telephone.

"Kortney here."

"Are they sleeping yet?"

"Negative. They're wired for medical TM and there's no question they're awake. They're coming down slowly from that peak they were on."

"Okay if I talk with them for a few minutes?"

Kortney glanced at DeGrote. The mission director shrugged. "Your decision," he said.

"Hold one," Kortney said into the telephone. He turned to Spencer at the CapCom desk; Wheeler was on a coffee break. "Spence, can you patch this call to Ironman? Good. Set it up right away." To the telephone: "We can do it. Spencer's patching you in right now."

"Good. Let me know the—"

"They're in now."

"Ironman, this is Houston."

Again Kortney spoke into the telephone. "You got that?"

"Roger."

"This is CapCom," Spencer said. "You're patched in. Who is—" Spencer cut himself off as Kortney motioned him to silence.

They heard Pruett's voice answering Spencer's first call.

"Flight, Ironman here. Go ahead."

"Listen, you bum," the voice rasped. "Take your damn pills and go to sleep. You want to do something, lie back, shut your mouth and grow a beard, hear?"

The first free laughter they'd heard in a long time whispered down from space. "That can only be that dark-haired, fat-mouthed hero known as Ted Dougherty," Pruett called back.

"You bet the both cheeks of your ass it is," Dougherty countered. "I'll see you clowns in exactly thirty-nine hours and sixteen minutes."

The video monitors couldn't carry the scene in the dim spacecraft cabin light. But there was enough earth reflection coming through one window not to leave any doubts.

Three men marooned in a lethal celestial trap were grinning broadly. Pruett's voice came in again. "Hey, Ted, where are you?"

If Pruett could have seen Dougherty, it would have been through a maze of cables, wires, scaffolding, portable lights and a mass of electronic equipment surrounding and leading into a facsimile of an elaborate spacecraft cabin. Men moved within the simulator and surrounded it on all sides. Dougherty had donned a pilot's crash helmet; insulated by the hel-

met and speaking into an oxygen-mask microphone he could hear clearly despite the racket about him.

"Huntsville. I—"

"Say again, Ted."

"I said *Huntsville*—"

"Alabama?"

"The one and the same, Space Cadet. We—"

"What the hell are you doing in Huntsville?"

"They had the X-RV simulator in assembly down here. Testing out interconnections to different stages. Don't you ever read the newspapers?"

"For Christ's s—"

"I'm living in this mother until we're ready to launch from the Cape. It's going fine."

"This is a hell of a time to start learning how to fly," Pruett almost shouted.

"Nothing to it. I got me a handy-dandy do-it-yourself erector set instruction book. It's got big pictures. Now listen, you birdbrains up there. This is just a brush-up while they move the bird down to Pad 41 at the Cape. When I get you stumblebums in this bug I'll lay you down on the dry lake at Edwards so smooth you won't even know the trip's over until you open the hatch and fall flat on your face. Got that?"

"Why not?" Pruett chuckled.

"Hey, Buzz, better brush up on your gin. I know Pruett can't take you but I could always wax your ass any day in the week."

"Shaddup and deal. And bring a new deck, willya?"

"Right. Say hello to Stoney for me."

"Say hello yourself," Stone broke in.

"Can't. I never talk to geniuses. Take your pills, you clowns. I'll see you. Gotta hang up now; the operator wants another dime." He broke the connection.

"We'll be here," Pruett said softly.

They fell into the nightside of the earth, the lights of the cabin extinguished except for the green light with its maddening *Retrofire*. Stone opened a plastic box and extended his arm. Pruett took a pill, Lloyd another. Stone snapped the box closed, placed it within a pocket. He slipped the pill into his mouth and swallowed. To his left, at the left side of the cabin, Pruett tugged his straps tighter, then swallowed his pill. Lloyd shifted his body position beneath his straps, brought his pill to his lips, then concealed it within his hand.

Chapter XIV

He said a silent prayer. More than any other man, Charles Keith knew only too well the odds against what they were attempting—were going to attempt. Since the evidence seemed conclusive—the crew of Ironman was beyond all question lost to all help through their own facilities, or those on the ground—the majority of NASA and Air Force engineers and officials were against the emergency rescue attempt with the Titan IIIC and the X-RV lifting body. They felt much as did Keith. In this business, whether or not the people involved could be counted among your closest friends, you could not and must not permit emotion to rule your decisions. It wasn't the matter of a man risking his life, as Ted Dougherty certainly was going to do. It involved—hell, he'd run that through his mind so many times his thoughts were turning to cement in his skull. But once there had been the national commitment, once the President himself felt compelled by emotional, personal, political, diplomatic and a dozen other considerations to commit himself to the rescue, Charles Keith threw himself with unabated energy into the task. And he knew that only he could pull it off. Sure, the President had offered him a way off the hook. But both men knew when that question was asked that Keith would never turn his back on the mission to be flown. No one man knew all the systems so well. It took astronauts to fly to the moon and man space stations, but they were the recipients of an incredibly vast and diverse effort. That effort

would grind to a halt without a few key individuals who understood intrinsically not only every small and individual facet, but the "big picture" as well. And Charles Keith, admitting the facts to himself, was aware that no one man commanded his depth of experience, his knowledge, or his ability to make the right decision in the clutch. That was his greatest asset—making the right decision at the right time in the right place. He knew this and he knew that success or failure, or as much of it as could be counted beyond the purely technical and the random factors, lay within his hands.

What rankled Keith deep inside him was the practiced skill he had developed in performing this job by the book. This was the last thing in the world that could be approached in a slapdash or haphazard way. They were working with celestial mechanics that were immutable—to change that element of a mission you'd have to change the orbit of planets, which was what it literally entailed. So you had to fit everything into these fixed requirements, you had to coordinate and intermesh and weave exquisitely, on schedule. Frantic attempts were suicide—personally, technically, and fiscally—in this business. But there was no way out.

They must throw away just about every precaution they had ever built into the system—the system of the organization and that of the machinery. Not only were they throwing away their inherent safety factors but they were stripping even the reliability of systems developed with such painstaking care over so many years. They . . .

Charles Keith forced his thoughts to a grinding halt. Enough of this crap, he told himself. It's time to stop wallowing and start thinking positive. He grinned to himself because he knew he was right. You were committed. Screw the negatives and press what you had going for you right down to the wire. To hell with failing. Try winning for a while . . .

He thought quickly. That meant throwing away checkout procedures. It meant throwing away entire checklists, page by page and chapter by chapter. He was no longer interested in checklists that took weeks to perform and precautions that were part of any normal operation, because, goddamnit, this *wasn't* a normal operation, but *the* classic instance of life or death for three men, and perhaps an entire national effort, riding on the outcome.

And hadn't they—and he personally—learned their lesson *yet?*

He forced his mind back to his own beginnings in sending men away from the planet of their birth. It was hard to believe in the face of all the success that had been accumulated through the years, from Mercury to Gemini to Apollo, that from its very beginning the engineers (and he included himself) had designed the one-man Mercury spacecraft and all its supporting systems on the *inevitability* of failure. It became almost a religious tenet that they must have catastrophic failure. It was a fact of life, despite the realization that it had yet to be established. It was fact before the fact.

It was almost as if success was something that *could* happen, if the tin-can Mercury capsule survived the gauntlet of imminent disasters. We learned a long time ago to say "Screw that stuff," Keith reminded himself. The first American to go into orbit, the man who spent eighty-two days waiting at the pad so he might go around the world in ninety minutes, John Glenn, had said it best of all after his flight. At long last, John said, we've piped man aboard as the master, instead of the passive passenger of his spacecraft.

That was the philosophy they learned as a result of Mercury and it became the bedrock of the design and operational philosophy of Gemini. *Manned control*—decision by the two people in the spacecraft. Even the abort-system philosophy of Mercury was tossed out the nearest window. The electronic wizardry of the supersensitive black box, vital though it might be and indeed was to any mission, couldn't replace man and in many instances couldn't do many vital tasks as well as could the human pilots. Pilots, *not* passive passengers.

In Gemini we heeded the lessons of the past, Keith mused. We went back to the original concept of the *pilot,* and thank God for that. We found these people could have their reaction times measured in fractions of a single second. It worked so astoundingly well in Gemini. It continued as the bedrock for Apollo. The pilots who became astronauts weren't just good, or even great; they turned out to be the *best* that ever walked or flew or maneuvered in zero gravity.

It's about time, Keith told himself, that I threw my own complete confidence into what *I've* been preaching for years.

I'm going to lay my career on the line.

Ted Dougherty's going to lay his neck on the chopping block.

And almost everyone has given up three good men for dead.

I'm the one on whom they're counting to pull this thing off. So why in the name of hell am I clouding my own thinking with doubts and what-ifs?

The Titan IIIC was a proven booster. Its record was tremendous. So what if the mother hasn't been man-rated yet? It was designed from the outset for man-rating. It was the booster for the abandoned Manned Orbiting Laboratory. Doesn't *that* count for something?

The same principle applies, Keith lectured himself, to the X-RV. The lifting body from its concept was intended to fly into space, do its job, and come home. They were going to commit a man to such a mission within a year. Unmanned flights had proven the soundness of the system.

And if Dougherty was willing to stake his life on the wicked little machine, how could Charles Keith do less than support the man in his decision? Keith didn't doubt for a moment that Dougherty could fly the bird. He had the stuff; he'd proven that many times. It wouldn't, of course, be a matter of walking into a successful rendezvous, because there was so little allowable margin for error. But what about all the rendezvous missions with Gemini? Between Gemini spacecraft and between Gemini and Agena. And Apollo. All those flights, all the way to playing tag around the moon. Didn't all *that* count?

By all that's holy, Keith swore, we've been given a chance, *and we're going to take it!*

Chapter XV

The doctors were doing a landslide business with dexadrine and the bottles of pep pills. There was too much to do in too little time, and sleep was a nagging biological necessity that simply must be shunted aside—for just a little while longer. Those men who found it possible to drop away from their work did so with catnaps, on benches and on floors behind desks, in cars, anywhere.

The job of preparing a new spacecraft for its mission into orbit normally required, as Charles Keith had hammered home to his staff and the Air Force group, a minimum of six to ten weeks. But that was when you were planning to go into orbit as a normal step in a normal mission. Experience taught you how to speed up your preparations. And then, if you had behind you an extraordinary record of actual performance, a track record with meaning to it, you had the opportunity to take the big gamble.

The X-RV—Experimental Re-entry Vehicle—had never before flown through space. It had breached the upper edges of the atmosphere but the "flying bathtub" shape had always flown under limited performance. Research flights had been planned for the X-RV that would compare with the original Mercury missions in which Alan Shepard and Gus Grissom were lofted above the atmosphere by the old Mercury-Redstone booster, a pop-up flight into space that lasted from liftoff to splashdown a total of some fifteen minutes. But the

flight proved out the basic system and cleared the way for Glenn to make the big try.

This is what the Air Force and NASA, jointly developing the X-RV, had planned for the machine the pilots called the Wingless Wonder. Air drops from a B-52, in the same manner as the X-15 flights, would get the bird on its way, and a rocket engine would kick it out of atmosphere for the swift re-entry descent and then a winged-style descent (gliding at five hundred miles an hour) to a hairy landing at the dry lake bed in California, near Edwards Air Force Base.

Now there wasn't time to fly the X-RV in this elegant, cautious and sensible fashion. Now it was all the way. The basic design of the machine helped to commit Keith to the decision, as it had already convinced Ted Dougherty.

The hard-line design for the X-RV was one that followed the two-man Gemini spacecraft. Modular and plug-in concepts were its design backbone. You didn't stack things into the ship in a haphazard layer-cake design. Everything was "plugged in," with receptacles ready and waiting. If a particular electronic unit didn't work, you didn't spend weeks or days waiting for repairs. You yanked it out, pulled a replacement from the shelf; you took only minutes to connect the replacement to the checkout equipment, and the prepared circuitry did whatever joggling and tracing its electronic components needed, and you found out quickly if the unit was ready to go. If so, the technicians opened the access doors in the X-RV, carefully slid in the replacement, and hooked it up securely. They ran a fast power check, assured that it tied into the vehicle circuitry, and went on to other business. There would be a final checkout of the X-RV and its systems and subsystems as a single package, but the point was you weren't a prisoner of time. What had required weeks in the early days of manned space flight could now be accomplished within hours.

There *could* have been other, sticky problems with the X-RV. Its in-orbit and descent maneuvering system, for example. It had never flown as a complete unit with the X-RV and it had never been intended for man-rating. But it *had* flown at least nineteen times as the transstage engine of different Titan III configurations, and it had made another dozen flights aboard other Air Force missions of which the public knew nothing. It had never failed. It was so reliable the Air Force referred to the system as its "switching engine" as it performed orbital ballet maneuvers far beyond the earth.

No one questioned it would work again. Least of all Ted Dougherty, who would stake his life on it.

The booster was another matter. The crux of it was that when you intended a booster to fly with human life at stake you designed all manner of redundancies into the system. In all areas considered to be critical you added backup systems. You accepted a penalty of increased complexity and weight in order to give the human crew the best chances for reliability and survivability. You added sensors and detectors throughout the system so that if you were going to have a breakdown or perhaps a catastrophic failure, you got some warning and you could do something about it. If the booster wasn't intended from the outset for man-rating, you just didn't have these things. And there wasn't time to add them to the system if you needed that booster in a hurry.

Unless you threw the rule book out the nearest window.

They were doing precisely that, of course, or there wouldn't be even the ghost of a chance of saving the crew of Ironman One. Yet Charles Keith believed they had an excellent chance of carrying out this small miracle among many miracles controlled on schedule. The Titan III-C booster, with several dozen flights behind it, had proved to be an extraordinarily reliable vehicle in terms of missions completed and in a diversity of performance demands in space. Reliable was hardly the word.

In all the many tests that started the Titan booster on its long and varied life, there had been an astonishing lack of failures. The first in the series was the Titan II ICBM. Only *one* of those boosters, in a design and test series that put the huge missile through torturous conditions, had failed. The vehicle proved so reliable, in fact, that it became the hands-down choice as the booster for Project Gemini.

Gemini went through one suborbital and eleven orbital flights, of which ten were manned. Failures: *none*. The other side of the coin wasn't merely success. It was a series of manned flights with the booster drilling the spacecraft with needlelike precision into the desired orbits.

Then came the Titan III series that began with the IIIA variant—a basic Titan II with a transstage atop the whole assembly. There was a version that had the two stages of Titan I plus the transstage *plus* an Agena-D atop that, and the Air Force for years had been whipping its secret payloads into polar orbit from Vandenberg on the West Coast using this assembly. There was the ill-fated Titan IIIM—ill-fated

only because fiscal drought cancelled the MOL program, and the basic Titan III design, with two seven-segment solid boosters on each side of the liquid core vehicle, never had a chance to make it off the ground.

But there was Titan IIIC which *had* made it off the ground to become the nation's heavyweight workhorse. Where the old and reliable and much redesigned Thor-Delta was NASA's workhorse for payloads in the lower weight range, it was the Titan IIIC that was the real heavyweight for space missions—as much as 25,000 pounds in earth orbit. Aside from its performance record, there was yet another element of the IIIC that made it a natural for the rescue mission.

Charles Keith reviewed these items and corrected himself. There was never any one issue, always several. It was astonishing how the Air Force booster fitted everything so neatly.

One: the booster had a track record behind it.

Two: the launch facility was keyed up and current for a launch.

Three: while the entire boost vehicle wasn't yet at the Cape, at Pad 41, the missing components were already en route.

Four: it would be ready in time, in terms of vehicle assembly. They'd stack the core stages with liquid propellants in the towering VIB. Railroad cars would haul the assembly, along with its launch umbilical and servicing tower, further to the east where it would enter the SMAB. Here, in the Solid Motor Assembly Building, the five-segment stacks would be mated with the core vehicle. Assembled except for the payload, the whole kit and kaboodle would be dragged by the Diesel locomotives along an arrow-straight stretch of rail to the launch pad itself. On the pad, the booster would be surrounded by the great service tower. Here the payload would be installed.

Five: the payload itself, the X-RV, wasn't at the Cape. Normally a payload had to be on scene months before a manned flight. The X-RV was in Huntsville where it had been flown from the Martin Company's plant in Delaware. Modular packaging meant swift checkout and acceptance for flight readiness. How to reach the Cape in time? *That* was a bastard until an Air Force captain came up with the answer. The problem had been ferrying the machine. To put it aboard a transport meant loading it in special containers, trucking it to the nearest main airfield, loading the thing, flying it down to the skid strip at Cape Kennedy, unloading

it, trucking it to the launch pad and then hoisting it to the top of the service tower. It wasn't a long time block in terms of previous deliveries but it was *too* long for *this* mission.

"Why go to all that trouble?" the captain asked. All eyes turned to him. "I figured out the time hacks and you won't make it," the captain said. Someone started to chew out the captain for stating the obvious, but was silenced with a gesture from Keith. The young officer, he figured, knew what he was doing. He was.

"The big rescue chopper we fly," he said, "can carry a payload a couple hundred pounds bigger—heavier, I mean—than the whole X-RV. I suggest we sling the spacecraft under the Sikorsky helicopter, lift it right from where it is, and fly it down here nonstop."

"It hasn't the range," someone snapped.

"No, but it can have in less than ninety minutes," came the reply. "We're set up with collapsible fuel cells. We can put these in the chopper, fill them, and with our direct flow to the main tanks, we have enough fuel to hack the job."

"But you'll be overweight," someone protested.

The captain grinned. "You don't tell no one and I won't," he said.

Keith looked at him. "Go, boy," he said with a smile. The captain was *gone* . . .

Six: ah, the fly in the ointment. Making sure, under all these emergency conditions that were ripping normal procedures apart, that the booster would be ready to go at the exact time required. And in this instance *exact* time meant down to the specific second. Because it would be necessary to effect rendezvous with Ironman right in that initial orbit—or Ted Dougherty would find three dead men in the spacecraft. But as serious as was the problem, it could be solved by only one booster in the national inventory. And, by the grace of God, Keith thought, that booster was what they had—the Titan IIIC. The liquid-fueled booster lacked the shrieking, supercold liquid oxygen and liquid hydrogen of the large NASA boosters. It uses hypergolic fuels so there is no loxing, no vent-valves operations, no chilling of the plumbing system. The fuel is loaded days before and it stays there and all you do is measure it and add a few gallons if you've lost them. You keep them at ambient temperature. It's like pouring gasoline into the tank of your car.

As far as the liquid-fueled core was concerned, it didn't even light for liftoff. That was the job of the powerful solid-

motor assemblies that slammed the bird off the pad with nearly two and a half million pounds thrust. When the vehicle was miles high and ripping through thinning atmosphere, the solid assemblies were ejected violently and the core vehicle—the main stage of the Titan III—erupted into life. At that instant when it would be time to *Go*, the two combustion chambers at the base of the Titan III would receive their flow of dimethylhydrazine and hydrazine and nitrogen tetroxide. Because this is hypergolic fuel—self-igniting like the fuel within the command and service module engines of Ironman One—the fire is instantaneous and the core vehicle accelerates as quickly as the flame rips downward. It's a flame that is hardly visible because of the lack of hydrocarbons in the fuel. Visible or not, Keith mused, what counts is that it's reliable, it's got the power, *and it's available.*

The lower or first stage of the Titan core vehicle would blaze to burnout when its fuel was extinguished. As soon as the two engines of the first stage shut down, there would be explosive separation of the upper stage and a single engine, burning the same fuel and igniting in the same manner, would slam the X-RV ever higher and faster until the vehicle was in orbit. From that point on, Dougherty would maneuver with the modified transstage engine and use the reaction thrusters of the spacecraft itself for his attitude control.

All very neat. It had every chance of working, too.

If they could get the whole mess ready and coordinated to the required exact instant of time.

The X-RV would have to be modified in a rip-tear-and-patch operation. It was designed for two men—the commander and pilot. Or pilot and copilot. The terms didn't matter; they ended up being two men. Dougherty would have to fly it alone. That left one seat alongside his own for one member of the Ironman crew. The other two men would be seated where, at the moment, reconnaissance equipment was stored. It was being torn out. The area would be weld-sealed. Lightweight seats—standard seats—would be bolted in their place, harness affixed, oxygen bottles bracketed within the space. It would be crude but entirely effective. The X-RV didn't slam back into the atmosphere as did the Apollo. Dougherty could bring it down on a long skip-glide maneuver and the men would never take more than two point six g and they could hack that without any trouble. After the long period in zero-g it might bloody their noses a bit but that was a cheap price to pay.

Still there was a problem to be considered. It could not be overcome through any mechanical adaptation, through a jury-rigged modification to either the boost vehicle or the spacecraft. The only solution lay in a decision to be made by Keith. Bluntly, a Go or No-go decision.

Behind the making of that decision lay the grave doubts and the objections to the concept of sending Ted Dougherty into space—*alone*. The X-RV was a two-man ship. From the very start of its design the success of its operation in space was predicated on each man within the spacecraft supporting the other. The major objections came not in the need for performance *after* orbit was achieved, but in the critical time of the long ascent into orbit.

If something went wrong during this phase, argued many of the engineers involved in the project, then Ted Dougherty would *not* be able to handle the spacecraft controls, monitor his instruments, coordinate with the ground controllers, *and* be able to blow himself free of the booster should the law of averages bring about that moment of catastrophe that every now and then claimed the great rockets.

And that would mean *four* men lost instead of three.

Those who felt the rescue attempt was a mistake—and Keith wanted to hear every possible scruple—quoted chapter and verse to back up their arguments. They emphasized the most critical danger points. They emphasized that if failure came during the time of maximum aerodynamic pressure during ascent, the aerodynamic instability created by sudden variations in the flight would cause the great booster to tear itself apart within *one second*.

Keith didn't exactly shrug off their objections, because these were good men, honest in their convictions, and equally as concerned as he for the lives of Pruett, Lloyd and Stone. But somewhere along the line you had to take the plunge. You had no choice but to gamble with the intrinsic values the engineers had designed and built into the equipment and the systems. With this behind him, a man could only make the decision to go ahead with what he had.

What would all these engineers have said before Charles Lindbergh made his solo crossing of the Atlantic in 1927? They would have said that no man had ever succeeded in so foolhardy a stunt. They would have stressed that the engine was unreliable for so long a flight, that the airplane would be disastrously overloaded for takeoff; the pilot could hardly see behind his massive fuel tank; the navigation instruments were

inadequate for the task; no one could predict the weather, and severe weather could destroy the airplane in flight. They would have had sufficient reason to deny that flight, and their reasoning, if put on paper, would have weighed more than did the *Spirit of St. Louis.*

Somewhere along the line you had to take the plunge.

Charles Keith went against the grain of those who felt the mission had more chance of failing than of succeeding. Keith believed that a failure—even the catastrophe of an exploding booster—didn't signal the demise of one Ted Dougherty.

Assume the worst, he said to himself. What happens then? Well, from his position on the launch pad until he reached a height of seventy thousand feet, Dougherty could blast the X-RV away from an exploding or disintegrating booster by yanking hard on a D-ring in the front of his seat, between his legs. Hauling on that D-ring would do several things, and all within four-tenths of a second. Explosive bolts would blow the clamp ring attaching the X-RV to the booster core. Instantly three solid motors would ignite and hurl the spacecraft away from the booster. They would burn for only two seconds, but in that time the spacecraft transstage engine would be howling, and accelerating the X-RV away from the booster.

What if the booster pitched up or down or swerved at such an angle that booster recovery was impossible, and breakup would take place within a second? It was easy enough to install a sensor within the X-RV that would detect any violent change from the programmed line of ascent. The moment the critical angle was reached from which booster recovery was considered impossible, the sensor would itself send the command to separate the X-RV and fire the breakaway rockets.

Okay. That takes care of *that.* Now, let's assume the booster fails during ascent, reasoned Keith. Dougherty separates and gets away cleanly. If he has enough height and isn't too far from land, he can attempt to glide back toward a field. That one was tricky, admitted Keith. You didn't jockey the X-RV around like a fighter because you didn't land it like one. You landed at more than two hundred twenty miles an hour and that meant you had time for one approach and that was all. Dougherty couldn't put the ship down at sea because he would hit with the impact of a dozen locomotives.

So?

So in that event he would use his ejection seat. The seat would explode away from the X-RV at a rising slant angle, and automatic systems would then snap his body away from the seat and deploy his parachute. The system was no more exotic than the many thousands of seat ejection systems in the fighters and bombers flown by every nation in the world, and there *were* thousands of pilots walking around who had escaped from emergencies far more critical than anything Dougherty was likely to get into.

Including a pilot named Jim Pruett.

Keith ordered a special meeting of the project supervisors and key personnel from the small army laboring feverishly to prepare the booster and the spacecraft. He didn't interfere with their work. He didn't take them away from their jobs. He held the meeting right at Pad 41. He discussed with them the necessity for rendezvous between the X-RV and Apollo as quickly as possible after booster burnout. They'd try for first-orbit rendezvous. They could still make it if they had to play it a bit cozy and maneuver the X-RV around a bit to do some orbital shuffling and wrap up the rendezvous by close of the second orbit. The disadvantage was that they were playing with an unproved system. The advantage was that Ted Dougherty was a master at orbital maneuvering. He'd done it enough times on his Apollo flights, and he'd carried out rendezvous and docking at least a dozen times.

"There's too little time to waste any," Keith told the assembled group. "I won't waste any of it with preliminary words or nonsense. But let it be understood I concur fully with the decision for this rescue flight. I'm supported one hundred per cent all the way up to and including the White House. The fact of the matter is, however, that *your* support is more important than that of the President and the NASA administrator. They can tell us to go ahead but you're the people who do it. However, the reason for this brief meeting is simple. If there are any objections, comments, criticisms, recommendations—*anything*—for God's sake, let's have it *now*. You may be able to spot something we've overlooked in the haste with which we've got to move. You may have an idea or two which will help. Let's have it now."

"Houston, CSQ here. Houston, CSQ."

"Go CSQ."

"We have acquisition. Ironman is six point five degrees south eight seven point one degrees west. Last pass apogee is two zero eight miles. Perigee is—"

"Roger, CSQ. We copy—"

". . . and the latest report from Mission Control is that the three astronauts are now in a sleep period. Pruett's heart rate is seventy-six beats per minute. Stone's heart rate is sixty beats per minute. Lloyd's heart beat is one hundred twenty beats per minute. Doctors at the space center believe that Buzz Lloyd is dreaming and this accounts for his high heart rate. They say this is no cause for alarm and the rate will settle down shortly. Another report indicates . . ."

"Kortney? Keith here. What's the problem with Lloyd?"

"It's obvious he's awake, Charles. You got the heart rates? We have the same sharp break down the line. Pruett's breathing rate is sixteen per minute and Stone is at twelve. But we've got thirty per minute for Lloyd."

"Go on."

"Pruett's blood pressure is one hundred ten over sixty-two; Stone's at one hundred over sixty-four. Lloyd—"

"For Christ's sake—"

"Lloyd is one hundred fifty-two over one hundred twenty."

"Tell Wheeler to patch in the TV scan to me here."

"It's coming through now."

At Pad 41 on Cape Kennedy they saw Stone's face on the screen. The monitor also carried a flow of wavy lines imposed over the video image of Stone.

"Deep, dreamless sleep," Kortney said. "That's a nice adjustment. Stand by one." Kortney pressed a button and the video scanner in Ironman moved to take in Pruett. His face appeared on the monitor as had Stone's. But instead of the flowing wavy lines, Pruett's image was covered with jagged lines.

"What's he doing, Kortney?"

"Damnit. He's dreaming. He shouldn't be with those drugs in him, but he is."

"You're the doctor. Why is he dreaming?"

"He's an angry, active man who right now is helpless and feels he's rotting his life away. Give them something to do."

Keith shook his head, remembered where he was. "Not yet," he said. "Pick up Lloyd, will you?"

Lloyd's face appeared. The TM lines were disorganized.

"Is he asleep now?" Keith was puzzled. "He wasn't sleeping just a little while ago."

"He's going in and out of sleep. Right now he's in. He's dreaming, too. From the looks of things a bad nightmare. I—"

"What the hell good are those drugs of yours?"

"Lloyd's not taking his pills," Kortney protested quietly.

"Damnit, Kortney, it's *his* engine that didn't fire—"

"Maybe," Kortney broke in, "he thinks stoning himself with drugs isn't the answer."

"How do you mean that?" Keith queried.

"Look. Instinctively, Buzz may be right. He may just be doing the right thing. Pilots break down just like machines do. I don't have to tell *you* how easy it is to get killed up there. Punch the wrong button, go EVA and tear your suit—"

"Get to the point."

"Lloyd's already had his share of making mistakes. Maybe he feels if getting dopy from the drugs will wreck what decision-making capability he has left, then he's better off not taking those drugs."

Keith mulled over the idea. "He may be right."

"Maybe."

"You're the doctor here. What's your opinion?"

"I'm the doctor *here*. I'm not up there."

"Stop playing word games."

Kortney refused to be ruffled. "I'm not. But it's true that there's danger in keeping them drugged too long. They've got to be alert well before Dougherty lifts off. Radio procedure. Getting into their suits. Checking each other out. Helping Dougherty make the transfer from Ironman to the X-RV. There's a lot to think about it in that sense."

Again the brief pause. "I think you're right. All right, Kortney. Wake them up. I want them kept busy. Keep them informed. Kid them along."

"That last item is easier said than done."

"So it's not easy. It's what you get paid for."

The flight dynamics group assembled in a small room, ordered coffee, and went to work.

John Novak spread several flight profile sheets out in front of him. "These are the profiles we've been working out with the Goddard computers," he began. "They've given us the precise orbital parameters of Ironman at the expected time of launch. They have prepared as well, for any subsequent

times, the figures, ah, to allow us to match any changing orbital parameters within the needs of guidance-control of the IIIC.

"Now, what we've—"

An engineer broke in. "Excuse me, John, but what's the profile? Do we have time for setting the X-RV up first in orbit and then carrying out a catchup phase?"

Novak shook his head. "Can't do that, Harry. We're working much too close as it is. If Dougherty doesn't slide into the groove within the first twelve hours after insertion, he's going to have three dead men in the other spacecraft for company."

"Twelve hours?" Another engineer. "He hasn't got *half* that time, John."

"But I thought—"

"I thought so too. It didn't work out. They won't be able to stretch the oxygen as far as we thought they could. We don't have that twelve hours any more."

Novak nodded slowly. "That means we can't use variable-azimuth launch. It saves fuel but it eats time.

"There's only one way. Optimum launch. We'll work on the basis of liftoff when the phase relationship between the target vehicle and the launch site is optimum. In other words, we sequence to go directly from launch phase into terminal phase. We shoot for the bull's-eye from the opening gun. It's the only way."

"Jesus Christ, John, that's almost impossible."

"Why is it impossible? Dougherty's got the basic computer we proved out in Gemini, hasn't he? If anything it's better."

"But on the first orbit—?"

"Hell, Pete Conrad and Dick Gordon did it in Gemini XI. Dougherty's got to do it first time around."

"All right. How does the pilot fit into terminal guidance of the booster, John? Keith said that Dougherty would have some control over the second stage."

"Well, not in the sense of flying the booster as a pilot. That stretches things just a bit too far for our capabilities at this point.

"We're going to shoot for parallel-azimuth launch, because it doesn't require anything exceptional from the booster. We're going to slap Dougherty right into the same orbital groove as Ironman. If anything, we want to get the same perigee as Ironman, but a slightly lower apogee. This gives us the built-in catchup rate.

"We want Dougherty to be able to chase Ironman. So we'll try for the direct—immediate—rendezvous by slinging Dougherty into almost the same orbit as Ironman. Both the perigee and the orbital plane *must* be the same. Dougherty will have slightly less time for a full revolution. If he trails Ironman after injection, he's going to be catching up with him. Now, because Dougherty has a lot of maneuverability in the X-RV, a lot more Delta-V than we had in Gemini, Dougherty can boot the X-RV in the ass or he can retro-thrust to drop his apogee. I don't think we want to mess with this because of the margin for error and the time bind we've got. We want the pursuit technique. Charlie?"

"John, how are you going to handle azimuth error? It seems to me that we're counting on too much when we expect Dougherty to slide right into the same orbital plane."

"We're programming—in the event of trouble in azimuth—launch-vehicle guidance in yaw. This is for the upper stage of the core vehicle only, of course. We do this by varying the launch azimuth of the spacecraft so that the azimuth becomes an optimum angle directed toward the target's plane. In this way we hope to reduce the out-of-plane distance *prior* to initiating booster yaw guidance. This cuts down the workload of the booster in correcting for yaw discrepancies, and gives us the best chance to slide into the same plane—or close enough to get that fast rendezvous.

"We can get tracking with sufficient accuracy to pick up a prime moment for booster cutoff. This is where Dougherty comes in. There's a ship on its way between the Cape and Bermuda for communications insurance. Goddard will pick up the track from Bermuda radar and correlate that with ascent of the X-RV. The seven-oh-nine-oh computers are fast enough to run a constant prediction for us—they'll be receiving radar tracks of both Ironman and Dougherty in the lifting body. From this data they can give us a warning about five seconds ahead of the best moment for cutoff—the moment that places Dougherty as close as possible to Ironman and in the best position to go for rendezvous. Now—"

"But where does Dougherty fit in with the manual control? I still don't see—"

Novak held up his hand. "Bear with me for a moment. The Goddard computers get their track from Bermuda radar. As you know, the FPS-16 at Bermuda is much more sensitive and accurate than most of the radars we use along the

ground track. That mother can separate two targets differing as little as twenty yards in azimuth at a range of a hundred miles.

"Now, if we had plenty of time to fool around, which we don't, we'd go for the slow rendezvous. So we'll count for a liftoff when Ironman is just passing Guaymas. Assuming four two six seconds for Dougherty's climb to injection, that should put both spacecraft close together near Bermuda at X-RV injection. This is where Dougherty comes in.

"The people at Goddard can utilize their impact-predictor system to help us with that immediate rendezvous. The Air Force tells me the booster on the pad has both inertial and radio command guidance. The latter is normally used only as a backup, of course. We'll use inertial guidance through the solid burn, full burn of the first stage, and successful staging and ignition of the second stage.

"Once we've got the second stage moving out, we switch from inertial to ground command guidance. The ground controller here at the Cape has a display readout from Goddard of the Titan as it climbs, and Ironman as the target. He'll be able to feed in yaw corrections directly to the autopilot in the booster, a sort of continuing correction. Dougherty will be getting a readout on the onboard computer on his visual display panel. As fast as ground control feeds corrections to the spacecraft computer, it issues steering commands. The system is so set up that the ground controller modifies the preprogramming of the computer's flight plan. The computer in turn adapts its new information to the flight plan. Since the autopilot is slaved to the computer, it obeys the changes in command. At the same time, the computer is giving Dougherty a constant readout of the changes.

"Dougherty will be watching that display, and in one of the display panels he'll see a retrotime signal come alive. He'll have to be fast; the best we can do is to give him first indication of prime—or optimum—cutoff at five seconds to go. He'll get a warning light and a numeral five on his panel. When the thing reads zero, it's time to cut the engine and get into his orbital insertion."

Novak rolled a cigar in his mouth and clamped down with his teeth. "We're playing this thing down to the wire. But suppose Dougherty gets some other information that shows him he's *not* in the prime position for booster cutoff? He's got his onboard radar which will be feeding him distance and

closure rates to Ironman. The whole point in this part of the operation is that Dougherty will initiate the cutoff by manual control, and then separate from the booster. *If* he gets some visual indication, and a radar indication, or both, he can either cut the booster engine before the prime moment is indicated on the computer panel, or he can extend it one, two, or more seconds.

"And then, being as sharp as he is, he's going to move in as quickly as it's possible to effect rendezvous. If everything works up to this point, we know that Dougherty should have visual contact with Ironman, and he'll try for the soft docking by eyeball. Now, if—"

"Christ, that's a lot of *ifs,* isn't it?"

"You have any better ideas? I *mean* that."

"No."

The workshop was a combination of a plumber's *and* an electrician's nightmare. An X-RV mockup spewed lines and wires as though its internal assemblies had been stretched out in spidery threads. In the center of the ordered mess, lying in a semisupine position, straps about his body to simulate the reality of the actual spacecraft, Ted Dougherty kept his hands on two controls and his eyes riveted to his display console. Those standing on the side heard his voice chant out the ritual of numbers and words as he had been for hours.

"Range, sixty-five. Rate twenty-four . . . coming in just a little under . . ."

He bit his lip and cursed suddenly. Some of the controls in the tight cabin were too far to his right. He reached for them awkwardly and, inadvertently, his left hand moved the translator grip. Quickly he brought instrument crosshairs on the console back to their proper location.

". . . okay. We're in for a three point four second burn on my mark . . ." Dougherty's eyes flicked rapidly from left to right and back again. "Five seconds to mark . . . okay, let's hack this mother this time . . ."

Out of sight of Dougherty an engineer moved his fingers swiftly over the control keys of a computer. New instructions went in and the flight plan fed to Dougherty went through its swift change. Dougherty studied the new numbers coming up on his radar readout. The radar gave a tone signal and Dougherty called out the figures—

"Range six-three . . . rate two-one . . ."

His hands moved in a blur between the hand controls, the computer, the display chart. Abruptly the tone signal went off again. It wasn't supposed to sound just then.

"What the hell . . ."

His right hand shot out for the radar control. A knuckle brushed another lever. Instantly red lights flashed on the panel.

"Cut the test! Cut it, damnit!"

The tone signal increased in volume.

"Cut it!"

The engineer at the control console smiled without humor and flicked his fingers across the buttons.

"Goddamn you. . . ."

Dougherty tore his straps loose and climbed from the cabin mockup. He walked quickly to the control room for the simulator and stopped dead as he saw Charles Keith standing behind the controller.

"You missed your target by twenty miles, Dougherty."

"How the hell—where did you come from?" Dougherty demanded.

"From the Cape. By jet. I'm going back within the hour. Now. You missed your target by twenty miles. Why?"

"He's playing that thing too fast."

"Negative." Keith's voice was ice. "This machine was designed for two men. One to handle the radar and the computer and the other to handle the controls. You've got to be both men and just as fast."

Dougherty shook his head. "I can't do it that fast."

"Can't?"

"No."

"The hell you can't. We do everything at once, Dougherty. That's how we stay on schedule. Now get back in. Show me what a great guy you are."

Keith sat down before the computer and punched in a new rendezvous problem. "Now, get back in your little red wagon and play that one."

Dougherty turned on his heel, returned to the simulator and strapped himself in. The panel came alive. Dougherty worked faster than before, grim.

The radar bleeped . . .

Charles Keith climbed into the copilot's seat of the T-29 jet transport. The six-place machine, kept waiting for him outside the building were Dougherty wrestled with the X-

RV computer, rushed him back to the Cape at better than five hundred miles an hour. Keith reached for the radio mike. He kept his hand off the transmit button for a moment and turned to the pilot. "Got the Patrick weather office?"

"Yes, sir. They're ready and waiting . . ."

They came awake almost at the same moment. Each man in the cabin of Ironman One slept with his lightweight headset on, so at the same moment they received the dim rising-falling wail in their ears. It was a sound to which they'd become accustomed during many long months in space, a sound to which they reacted instinctively.

They came awake but without sudden movement. Each face was much the same. Haggard, stubbled, bleary-eyed. There was yet another similarity. None of the three faces studied by anxious men in mission control showed any signs of expression. Buzz Lloyd was the first to come out of his stupor (as Dr. Kortney had anticipated, since he had kept the drugs out of his system).

"All right, all *right!* Turn that goddamned thing off, will you!"

Frank Piro on the CapCom desk cursed himself under his breath for delaying the cutoff on the signal.

"Hey, sorry about that, Buzz. Good morning up there, you characters. We've—"

"Hey, that you, Frank?"

"Right, Stoney. I was supposed to go to the ball game today but I drew the short straw and here I am. You guys awake for a status report yet or would you like a few minutes for some juice or coffee?"

"I gotta piss," Lloyd murmured.

"Okay. Why don't you take five? In the meantime, you can remove your body monitors for a while, if you'd like."

Frank Piro was careful to keep his voice cheerful and animated. Doctor's orders. Straight from Dr. Kortney who sat at the next console, monitoring every word and every action from Ironman. He studied the astronauts as each urinated into a relief tube. Pruett and Stone brushed their teeth and cleared their mouth with a disinfectant gargle. Kortney noted that Lloyd didn't bother. Stone fired up the heater, drew hot water and mixed them all some coffee. Kortney motioned for Piro to wait a few moments more. The stimulant of the coffee would do them all good.

"You guys ready to copy?" Piro asked when he received a nod from Kortney.

"Yeah, shoot," Pruett said. "Even your voice is better than these two cats snoring like they did all night."

"Right. Good to see you're awake and sassy. Thought you'd like an update on the mission status."

"You might say we have a slight interest," Stone said.

"Roger. Right now the solid stacks are being strapped on. The bird's in the SMAB and will be moved to the pad in about nine hours, give or take a few minutes. We've been tracking that hurricane you reported earlier. While you were sleeping, it took the turn we hoped it would. Behaving real nice now and headed out to sea. You'll be coming up on it pretty soon. We'd like you to give us a couple of views with the TV so we can correlate what you've got with the metsats. Can you hack that for us?"

"Tell us when," Pruett said with a casual wave of his hand.

"Well, you should be in position any mo—"

"I've got the camera in position," Stone broke in from the window. "We're just right to get what you want now. We're in a slow roll, so get it while you can."

He brought the camera to the window, held it steady for a clear picture, then moved it slowly to encompass the entire storm system. The hurricane formation was clearly defined, the huge spiral extending for many miles, the dark eye at the center starkly visible.

"It's a beast, all right," Stone murmured. "A real beast."

"Great pictures here, Stoney," Piro answered.

"Uh-huh. Got enough now?"

"Roger, Ironman. Would you replace the camera in its—"

"I know where it goes." It was the first time they'd heard sharpness in Stone's voice.

Frank Piro let it slip by. He waited thirty seconds.

"Say, you guys go back to sleep, or something?"

"We're having a wild party up here," Pruett called back.

Piro laughed. "Well, the broads can't go too far, can they?"

Pruett chuckled. "Anything'd look better than this raunchy bunch."

Kortney nodded to himself. God, at least they were trying to keep it from getting too heavy . . .

"You guys sure you've been taking your quiet pills?" Piro was asking.

"We are," Pruett said, "but the girls won't cooperate. They insist on moving around a lot."

Lloyd made a face. "Har har har. You guys are killing me."

"Well," Piro said lightly, "have fun. We'll be on standby here if you want any extra bottles sent up to your room."

"Great idea, Flight. The service has been pretty crummy in here so far. See you later. Ironman out."

Piro turned abruptly from the CapCom console.

For a while quiet filled the interior of Ironman. Stone made notes on a lined pad, Pruett staring at him. Finally Pruett shook himself from his lethargy.

"You never wind down, do you, kid?"

Stone kept his eyes on his pad. "I do the job I was trained for," he said. "One of those jobs was to observe systems under stress."

"That include us?" Lloyd broke in. His tone was harsh.

Stone ignored the challenge. "Sure it includes us. You, me, our gallant commander over there. We're a system. We're under stress."

"Okay," Pruett said. "I'll give you some data points. You know what I'm thinking now? I'm thinking I never made enough money at this business. That's what I'm thinking. I've flown just about every damn thing there is with wings on it and a couple more that had stubs for wings and a few that didn't have *any* wings on them. So how come I can't make it and other guys in this business come up smelling like roses? All over the world there are guys who're captains of 747's and they're making sixty grand a year. Me? I'm a hero and I don't have a dime. You getting all this, Dr. Stone?"

Stone nodded, ignoring Lloyd's scowl. He kept writing.

"I'll tell you something else," Pruett went on. "I'll never get that moon job. I've wanted it for years. I wanted the shot at the moon and in the back of my skull I've always wanted to go to Mars. I'll never make the trip. And you know why?" Pruett gestured lightly. "I'll tell you why. I look old. Old, goddamnit. I should've dyed my hair. If I had nice, thick, black hair then they'd let me go to Mars. Right?"

"Could be," Stone said quietly.

"Oh, I forgot. It's also got to be shiny or greasy or something like that," Pruett added, "so that when they take my picture the hair will shine, like a real hero."

"You really want to go to Mars?" Lloyd asked.

"Sure. Doesn't everybody?"

"I should think you got enough of this shit," Lloyd scowled.

"I'm not ready yet to hang up my wings, friend," Pruett said softly.

Lloyd turned from the penetrating gaze of Pruett and stared at Stone. "Stoney, what you doing that for?"

Pruett didn't give it a chance to start. "Relax, Buzz," he said quickly.

"Don't tell me what the hell to do!"

Pruett backed off. He didn't want Buzz to have a chance to tear loose. Stoney filled the gap.

"Buzz?"

"What?"

"You remember the psychologist at Brooks? The one with the blank sheet of paper—"

"I don't remember."

"Sure you do. He held up a blank sheet of paper and looked at you and then he said: 'What do you see?' "

"I don't remember no—"

Quickly, Stoney turned to Pruett. "Do you remember?"

Pruett reversed it. "Tell us what *you* saw."

"Me?" Stone smiled softly. "I saw a blank sheet of paper."

"No imagination," Pruett said.

Stone shook his head. "Devotion to truth." His pen moved again across his pad.

Pruett's voice came out angry, the words in a rush. "Why don't you take that Ph.D. and shove it?"

Stone refused to answer. The pen kept moving. His silence was rebuke enough for a man he knew as closely as Jim Pruett.

"What do you do when you're finished?" Pruett pressed. "Drop it out the window in a bottle?"

"I'm the scientist. I rely on the pilot to get me places."

"Very pretty." Pruett clapped his hands in a mockery of applause. "If we had a couple more pilots we'd have been outside this shitcan instead of lying around like a bunch of cripples."

Stone couldn't miss the self-rebuke in Pruett's voice. "Tell me, Jim," he said. "What *did* you see when the psychologist held up the blank sheet of paper?"

"They didn't have that kind of crap when I came in."

Lloyd's voice came to them, softer than before, reliving a dream. He caught them both by surprise.

"I—I saw a field," Lloyd said. "I saw a field covered with

snow, and underneath there were new oats. Pretty soon the snow will melt and then the field will turn green. That's what I saw. But then that frigging psychologist said it was wrong. *I* was all wrong. He said there was nothing there but a blank sheet of paper."

"And they took you anyway?" Stone queried.

"Maybe they made a mistake, huh?" Lloyd said.

"Uh-uh." Stone shook his head and smiled. "They don't make mistakes."

"That's right," Lloyd came back. "I forgot that. They don't make mistakes."

For several seconds there was silence again. Then slowly, as the absurdity of what he had been saying revealed itself to Lloyd, he began to laugh. Chuckles grew into snuffling laughter and then into a near uproar of laughing. Stone and Pruett grinned at one another. Moments later, with Lloyd's booming laughter bouncing off the walls at them from every direction, they also exploded in mirth. They roared, tears starting from their eyes, pointing fingers at one another, choking and spluttering as they howled and shouted with laughter.

Slowly the same thing happened to each man. The laughter swelled in volume, broke over them like pounding surf, squeezing the cabin, cramping them, dissolving into a coffin shape. Lloyd's eyes bulged as dials and knobs loomed terrifyingly at him, out of proportion, huge dead eyes staring at him. Disorientation came crashing out of nowhere. The cabin began to rotate, spinning around and around.

"Mother of God," Lloyd hissed through clenched teeth. *"I'm getting vertigo. Hang onto me. Hang onto me! Jesus—"*

They unstrapped and pushed toward him, moving with sudden urgency.

They were so engrossed in helping Buzz, talking to him, holding his head steady, telling him again and again to focus on one object, that they failed to hear the ground calling them until the words were repeated several times. Finally, the sound of the radio penetrated to them.

"Ironman, this is California CapCom. This is California CapCom calling Ironman. Do you read? Do you read?"

Pruett pushed back to his couch and hit the right switches. His voice came out thick and gravelly.

"California, Ironman."

"Hello there, you guys. Is Buzz up and around?"

Lloyd looked up, disturbed by the unusual reference. "Wha —? What the hell is he asking that for?"

"California, Pruett here. Yeah, he was out walking the dog but he's back now. What's the story?"

"Ah, Ironman, we'd like Buzz to take a look out of the commander's window, please."

"What the hell for?" Lloyd screamed at him.

"California, would you—"

"There's somebody down there wants to say something to Buzz."

"Jesus Christ," Lloyd swore, "we're all going crazy."

"Say again?" Pruett barked into the microphone.

"Why don't you guys look out the window?"

Slowly Pruett turned, holding out his hand to Lloyd. He eased the other man to the window. Lloyd pressed his face against the glass.

Far below, the earth lay in almost complete darkness along the southern tip of California. Then a glow appeared, fighting through broken clouds. The glow vanished. It came back again, brighter. Off, then brighter still, until it gleamed like a star on the surface of the world. Once more it went out and once more it reappeared.

They heard California CapCom from a million miles away.

"That's San Diego, Buzz. Your home town's saying hello to you."

The giant rocket eased from the flat-sided building with exacting care. Two Diesel locomotives growled with subdued energy, handling their precious cargo with precisely controlled speed and acceleration. From the SMAB the railroad tracks arrowed without a waver to the waiting orange-and-white service tower of Pad 41.

Standing alongside a car on the perimeter road to the pad were Charles Keith and Colonel Ike Saddler. For several minutes they watched in silence. The booster had moved from the VIB, into the SMAB, and out again in a time period that only a few days ago would have been considered flatly impossible.

Ike Saddler was all business but couldn't altogether hide his pride.

"Well, Mr. Keith, how's it look to you? We're right on our schedule. Right down to the minute."

Keith looked at Saddler, his face emotionless. "The X-RV will leave Huntsville in one hour, Colonel Saddler. It will be

on your pad in five hours. That gives you nine hours to get ready and you're *not*, I repeat *not*, going to make it."

Pride vanished. To Saddler's credit his response was other than anger. "Look," he said. He thumbed through his ground checkout manual. "We've cut everything to the bone and we've still got eight separate systems to verify."

"I said you won't be able to make it."

"But—"

"Damnit, man, you sat there in my office and told us how great you were! I took you at your word. Are you telling me we've led three good men down a primrose path because you can't keep your damned word?"

"We've got to verify these systems!" Saddler protested. "I don't know how we can do it any faster. We—"

Keith grabbed the book from the colonel's hands. He jerked open the cover, thumbed quickly through until he found what he wanted. His powerful hand grasped a section of pages and jerked suddenly, tearing away the pages. Keith hurled them away into the wind.

"There!" More pages, more tearing, more sheets fluttering away. "And there, and there. *That's* how you'll do it."

Dismayed, Saddler stared at the ruined book, at the pages blowing away before the wind. Keith rammed the book back into the colonel's hands.

"Colonel, you've got automatic backups designed into all your systems, right? That's the story out of your office for years. Now, colonel, *now* you're going to find out if they work."

Chapter XVI

They were tired and unshaven and their interest in the poker they played was desultory at best. The card room in the Press Club Building on East Fortieth Street in Manhattan held perhaps twenty newsmen. In the room adjoining were television monitors, wall speakers, and other equipment that provided a direct link with the Manned Spacecraft Center in Houston. It was a hell of a lot better than traveling all the way to Texas whenever something happened in this business. They had the direct link for audio-video two-way conversaton for press conferences, and if NASA was going to open the video coming in from orbit, they saw it just as well right here. At the moment they were on a form of bastardized standby, waiting for the next report from Mission Control. They were used to waiting.

Nothing had happened, nothing was happening, nothing really could happen, but the hard core of the press gang had been in the business long enough to know that at such a time the totally unexpected and the impossible was most likely to hit them right between the eyes. So they kept open their direct line to Mission Control. Except that those poor bastards down there seemed to know less than anyone else. Several men in the card room sprawled awkwardly in their sleep, and the dining room, open twenty-four hours until the astronauts were either recovered or dead, kept up a steady flow of coffee. The more realistic among them had brought along a

liberal supply of Scotch and nursed the dragging hours with drinks and with weary profanity.

The telephone rang, the outside line. Bill Nowaslowski of the *Post* groaned with the effort and lifted the phone to his ear.

"Press Club. Whodya want?"

His expression froze and he sat bolt upright in his seat.

The movement commanded instant attention. The poker dealer sat rock still, and the sleepers were rudely shoved awake.

Everyone looked at Nowaslowski.

"*Slower*, goddamnit!"

He listened carefully, and his mouth worked as he started to speak, but waited.

"Give me that again—wait, hold it a second—" Nowaslowski cupped his hand over the speaker and turned to the room. "There's another ship in orbit! Another ship—it's up now, in orbit with Ironman!"

Chairs were overturned in the rush to telephones, and voices rose in a babel.

"Shut up, for chrissakes, so I can hear the rest!"

Instant silence.

"Yeah—go ahead." His eyes opened wide. "It's moving in? Rendezvous? When?" He came slowly to his feet.

"Yeah, yeah, I've got it. You'll call with anything else, won't you? Christ, yes. Thanks." He replaced the telephone slowly.

"Well, c'mon! What the hell's going on?"

"There's another ship up. Radar reports starting to come in from all over the world. I—I think he said they were getting closer, the two ships, I mean, and that they were talking about a rendezvous—a docking, I think."

"Goddamn! I *told* you they had something cooking down there at KSC. Goddamn, what a story! I knew, I just *knew* those bastards down at NASA were giving us a lot of crap. Hey, Bill. *Bill!* When do they think the Apollo will get to Ironman?"

"Apollo?"

"Yes, stupid! When will the Apollo rendezvous with Pruett and the others?"

"Who said anything about Apollo?"

"But you just—"

"*It's a Russian ship.*"

Chapter XVII

Two events, each separated by distance, and each bound inexorably by the forces of space and time . . .

A land of gently rolling hills and sweeping fields of tall birch and stately fir may be found on the surface of the earth at 47 degrees 22 minutes north latitude and 65 degrees 25 minutes east longitude. This is the place called Baikonur. In the midst of the hills and the forests a wide highway slashes its naked path. Other roads finger out from the highway, and some of these lead to huge concrete humps that brood in the earth and, when the sun is right on the horizon, bear the mottled shadows of enormous steel towers that jut ponderously into the sky.

Several days after the Apollo CSM called Ironman One separated from the S-IVB space laboratory to which it had been attached for several months, a man deep within one of the concrete humps in the rolling country of Baikonur was chanting the reverse numerology of an elaborate and exhaustive ritual. At the precise moment the man in Baikonur approached the emotional climax of his song-talk monotone, Astronauts Pruett, Lloyd and Stone lay within the bowels of their spaceship, placed exactly at 32 degrees north latitude and 48 degrees east longitude. The spacecraft and its faithful clouds of swirling iceflakes rushed silently through vacuum high over Iran. At that moment Ironman was some 300 miles

east-southeast of Baghdad, 350 miles southwest of Teheran, and moving in a direction just slightly north of east.

It was at this juncture in time that the man in Baikonur toned:

"Tri

"Dva

"Odin—"

And cried out:

"NATCHINAI ZHAR!"

At the same instant a bank of relays snapped against waiting connectors. Electrical currents surged through cables and initiated harsh and screaming activity. Eight hundred feet away from where violence erupted, men in the concrete hump peered through optical lenses and electronic eyes and collectively held their breath. They studied the first laboring movement of a great vessel ponderous in girth and volcanic in voice. It groaned through its structure and hurled its strength against the earth. Flame reflected in garish and flickering tones against metal, licked hungrily at the structure of the launch table, and then, seconds later, touched only air.

High atop the assemblies of metal and fuels a great spacecraft lay beneath its protecting shroud of heat-resistant ceramic. Buttressed against the steadily increasing hammer blows of tumbling, complaining air and the touch of glowing fingers of friction, Soyuz XI bore within its sealed cabin a man who soon would be known to many besides the select group who knew his background and the many steps leading to this particular, unprecedented assignment. Cosmonaut-Colonel Andrei Yakovlev had begun the critical phase of his ascent from the earth into a mathematically precise balance of gravity, centrifugal force, space, and time—and one of the trickiest orbital side-stepping maneuvers ever conceived.

As the hand of acceleration squeezed him deeper into his white plastic contour couch, Yakovlev functioned in the superb manner of his predecessors who had blazed this same trail in ships called Vostok, Voskhod and Soyuz. Steadily he called off the readings of his instruments.

In sum, they were what they had been in the previous Soyuz flights and what they were supposed to be now.

"Zarya Odin, Zarya Odin . . . machina rabotayet kharasho!"

Spring One, Spring One . . . the machine is working perfectly!

All previous manned space flights of the U.S.S.R. had been flown along an orbital inclination to the equator of approximately 65 degrees, just as the Americans always flew their orbital missions at an orbital inclination of from 30 to 35 degrees. To climb into orbital-injection position for the standard flight path, the Russian spacecraft lifted vertically, rolled, and then began to pitch over via a curving ascent, on an azimuth, or horizontal bearing from the north, of 48 degrees. All Russian manned flights had faithfully followed the flight path along the heading of 48 degrees.

Soyuz XI did *not* follow the prescribed path.

N. D. Merkulov, Launch Conductor of the Soyuz XI mission, sat at his control console. His solid bulk rested with the impassivity of granite as he stared at the flight display readings on the electronic screen before him. The screen showed the great booster rocket continuing to roll. It had passed the desired azimuth of 48 degrees, and it continued to roll, swinging around more and more. Merkulov did nothing to stop this apparent error.

Behind the Launch Conductor, General P. L. Karpenko stood with arms folded, eyes following every movement, missing nothing. The trace of a smile appeared on his lips.

Two spacecraft communication officers maintained a running conversation with Yakovlev in the accelerating spaceship. Friedrich Rynin functioned as primary SCO: Vasily Borisov sat alongside Rynin, methodically checking off items on a list.

"Still climbing . . . it's going well, very well . . . acceleration and programming are optimum . . . We have positive performance all the way . . . We are optimum condition . . . going very, very well—"

On an exact azimuth of 90 degrees, rocketing upward in the curving line that led due east from Baikonur, the great booster split the stratosphere with its thick contrail and pushed eagerly into swiftly thinning atmosphere. The booster bent more and more to the horizontal and from the flaring engines there tore back a glowing, double-walled plume of ionized gases, swirling outward in a phantom teardrop a hundred miles across.

"Still going . . . going very well—"

"Spring One to Tadzhik. You are approaching initial BECO. Coming up on initial cutoff. On my mark, it will be ten seconds remaining to initial BECO. Counting now, ten seconds to go for initial BECO. Four—three—two—one—

MARK. Counting down for initial BECO . . . at seven—six five—four—"

Time from liftoff: 136.8 seconds. First-stage booster thrust in near-vacuum now registers 2,400,000 pounds.

"—three—two—one—BECO *NOW.*"

Time: 137 seconds. An acceleration force of 7.75g weighs heavily on Andrei Yakovlev. Thrust and acceleration will continue to increase to unacceptable limits. To reduce structural rebound, Engine Groups One and Three plunge into silence.

"Tadzhik to Spring One. Initial BECO exactly at one three seven. G down from seven seven five peak. Steady acceleration continues. All goes well. All readings are excellent. This is a wonderful ride, Friedrich!"

"Excellent, Andrei. TM confirmation is complete. Stand by for final BECO. On my mark it will be five seconds to—"

Time: 160.5 seconds. Engine Groups One and Four shut down. Final BECO comes with a mild 5.7g. At this instant the powerful first-stage booster has consumed 1,303,000 pounds of fuel and oxidizer.

Time: 161 seconds. Explosive bolts fire and sever the connections of the empty booster stage. Simultaneously with the cracking of the bolts, four solid-propellant retrorockets attached to the outer skin of Stage One ignite, and burn for exactly one second. The empty booster—75,000 pounds of useless structural weight—drops back from the upper stage.

Time: 162 seconds. Four ullage rockets burning hypergolic fuel at low thrust, attached to the frame of Stage Two, snap out brilliant fire spears. They will burn for four seconds and impart a low acceleration to Stage Two. The acceleration will assure that the fuel settles properly in the tanks for ignition of the Stage Two engines.

Time: 165 seconds. One second burning time left for the ullage rockets. A muted shriek sounds in the aft section of Stage Two. In his contour couch within the rounded walls of Soyuz XI, Andrei Yakovlev hears the sudden roar of thunder and grins happily.

"Spring One from Tadzhik. Staging successful. Ullage burn successful. Stage Two ignition complete. Ignition g is one one four. All goes well with—"

"Confirming sequencing and ignition of Stage Two by TM. Repeat—we have full confirmation all events sequencing and ignition. How do you like the view, Andrei?"

"It's wonderful! The mountains are very clear, and the plowed fields stand out as very dark in color. I can see the wheat fields—they are the color of lemons and very bright in the sun. The forests are a deep smoke-green and the contrast with the wheat fields is very sharp. There are scattered clouds . . . It is beautiful, incredible . . . I am getting very bright sunlight through the port. I can feel its warmth even through the suit. The booster is very smooth, very smooth."

Time: 182 seconds. The two engines of the upper stage burn with a combined thrust of 150,000 pounds. At ignition the stage contains slightly more than 101,000 pounds of fuel and oxidizer. Rate of consumption is 500 pounds per second. Total burning time is programmed for 202.6 seconds. The booster at liftoff weighed 1,510,000 pounds. At ignition of Stage Two, the stage and payload weight total 131,700 pounds.

Time: 185 seconds. The ceramic heat protector around the forward end of the Soyuz XI spaceship separates from the connecting clamps. Two small solid rockets fire briefly; the ceramic shield darts upward and sharply to the side, away from the path of the climbing, accelerating booster.

"Tadzhik to Spring One. Confirming jettison of nose shield. The shield departed in sight of the port mirrors. I saw a momentary flash as the rockets fired. Everything is now clear. Posigrades are armed. Acceleration building slowly. Cabin pressure holding steady at one five exactly. I am very comfortable—"

Corresponding to the terrain that unreeled faster and faster beneath the onrushing booster, the maps of men showed the border of China was now in the near distance.

"Spring One to Tadzhik. Coming up on three zero seconds to stage cutoff. On my mark it will be three zero seconds remaining to final cutoff. Starting the count now to mark. Five—four—three—two—one—MARK. Counting now to cutoff—"

Time: 368 seconds. The twin-chambered booster leaps into the abrupt silence of cutoff. Yakovlev's body strains against

its straps. Acceleration at cutoff is a mild 4.95g, and the sensation of translating from acceleration to weightlessness is pleasant. The cues of separation come clearly—dull thuds as explosive bolts separate the clamp rings, then a surge forward and a muted thunder from the posigrades as Soyuz XI slides ahead of the inert machinery of the empty, discarded stage.

"Spring One from Tadzhik. Everything is right on schedule. Separation sequence from booster completed. Posigrade ignition and cutoff came as scheduled. The, ah, autopilot has damped out all spacecraft motions. Now stabilized to horizon reference. Cabin pressure, temperature, power readings, fuel are all proper. This machine is marvelous! My condition is excellent. Over."

"Tadzhik from Spring One. Congratulations, Andrei! We have full confirmation of all sequences. Good news—your initial parameters appear good for at least one hundred orbits. We'll have refined parameters for you on your first pass around. General Karpenko sends you his congratulations and his best wishes. Have a wonderful trip around the world, Andrei! We will have—"

"Spring One, Spring One. You're fading rapidly. Repeat you are fading rapidly. Tadzhik is switching to Station Alpha, Station Alpha. Tadzhik out."

"Tadzhik to Station Alpha. Come in, Alpha—"

Soyuz XI and its massive transstage rocket assembly joined to the manned spacecraft slide into a precisely calculated and superbly attained elliptical orbit of the earth. Unlike previous manned spacecraft of the Soviet Union, Soyuz XI is now orbiting the planet along an orbital inclination of 47.3 degrees. There is a reason for this inclination, but it will become clearly evident only after the passage of the near hours to come.

The total weight in the 47.3 degree orbit is 30,400 pounds. The disposition of this weight in the 47.3 degree orbit is extremely critical to the mission as planned by General Karpenko and his staff. The empty—or dry—weight of the Soyuz XI with only one man aboard, and minus the special equipment and supplies normally loaded for four men—is 9,800 pounds. Within the spacecraft are a translational thruster system and 2,000 pounds of hypergolic fuel. It is this total

weight of 11,800 pounds which will soon come to have full meaning.

The remaining weight is taken up, first, by the 2,000-pound structure of a rocket transstage. The transstage has a single engine of 75,000 pounds thrust, and during its brief period of life (when the moment is at hand) it will consume a total of 12,600 pounds of hypergolic fuel. The working weight of the payload in orbit, then, is 26,400 pounds; the remaining 4,000 pounds are made up by the empty weight of the upper booster-stage rockets, which was summarily discarded upon orbital injection.

The orbit . . . its significance will appear slowly.

The looping ellipse of the orbit brings Soyuz XI, code-named Tadzhik (for the highest mountain peak in the U.S.S.R.), down to within 121 statute miles of the earth. At the top of the elliptical swing, the apogee, the spacecraft is well above the apogee of Ironman One. That is relatively unimportant. What matters is that the perigee, or bottom swing of the orbit, is much closer to the perigee of the spacecraft carrying three American astronauts.

At the moment that Andrei Yakovlev in Soyuz XI injects into his orbit, Ironman One is at 27 degrees north latitude and 74 degrees east longitude, over Jodhpur, India, and moving in the direction of east-southeast.

If all goes with the precision which the Russians have so meticulously planned—and which the daring mission requires —Pruett, Lloyd and Stone are in for a surprise, and Apollo Control in Houston is in for severe shock.

But in the Baikonur flight control room there is bedlam. General Karpenko and Merkulov show the flush of success, and even more to come. Karpenko slaps the other man enthusiastically on the back. "Comrade, it is time! Put the call to the Premier through at once!"

Hundreds of people milled about in the enormous room, talking with animation or extreme care, depending upon their company and their listeners. They were of many nationalities and from many governments, and in the rites of international relations they were present by invitation to join in the celebration of opening the first supersonic flights scheduled between the United States and the U.S.S.R. in the Tu-144 SST. It was during the party that an aide moved to the side of the Soviet Premier and spoke to him in hushed tones. The Premier left the room for six minutes exactly, and when he re-

turned he was smiling to himself. *Let them puzzle and wonder. The bait is always more succulent when they must hunger for it.*

For another hour he remained the congenial host. During a moment of conversation with his aide he received full confirmation of the orbits. *Ah! Very good! If it continues this way then we shall snatch their cosmonauts from the very jaws of death. And how shall we treat our American friends when we bring them so unexpectedly to earth? Perhaps—perhaps we should give them the red carpet tour of the lunar base training center. Yes, that would be good . . .*

"—do you think of those unfortunate fellows—the three Americans? It seems a terrible way for men to die. And so young! To be marooned in space like that—it is tragic."

The Soviet Premier looked blandly at the man speaking to him. *Ah, yes; from Italy. That newspaper chain. And—good—newsmen from France, and that little one, from the Japanese news agency. The timing is good.*

"But you are too pessimistic! You talk as though the young Americans were already dead. It is too early, I think, to be writing the obituaries of those young fellows."

He sipped at his drink. The Italian snatched eagerly at the bait.

"Do you think it possible they can be saved? There is nothing, really, they can do to help them!"

The Premier laughed. "You are so sure, are you not?"

"No—no, it is not that, my dear sir. But—" the Italian spread wide his hands and shrugged. "Without air, one cannot breathe. And it is only a matter of time before their air is gone. And then—*poof!*—their life will go out like candles."

The Russian leader cocked his head to one side. "Ah, but there are ways of getting more air. There is always hope. You give up on the life of these Americans too easily, I think."

Look at them—the newsmen are almost trembling, they are trying so hard not to miss a word. Good, good; come even closer, for it is better than my talking loudly.

The Italian belatedly came to his senses. He looked sharply at the Premier.

"Do you think it possible they can be saved?" he asked.

The Premier smiled at him. "All things are possible. And you know that our Soyuz is very big, that it forms the basis for our space stations and—well, who can tell? We shall have to listen to the news reports. Maybe they will have some interesting things to tell us soon. But, now! There is the de-

signer of our wonderful new airliner. Perhaps he can tell us what his plans are for the future—"

Twenty minutes later, in their respective offices, the newsmen were hurriedly preparing their stories to be cabled to their home offices.

The Premier smiled. . . .

Chapter XVIII

Richard Wheeler, Flight Director for the mission of Ironman One, now off duty from his console, was the first through the door, preceding three women. Guards nodded politely as Wheeler led the three wives of the men of Ironman One into Mission Control. The sprawling room was crowded with unshaven, coatless and weary men, two to three at a console normally used by one. Other men sat in chairs in the aisles or along cots that lined the walls. Some were sleeping, taking short breaks before they returned doggedly to their places. Most were officially off duty. None would leave.

Wheeler left the three women near a console. "Be back in a moment," he told them, a quick smile on his face. They nodded as he walked to the CapCom console to talk briefly with the CapCom on duty, Frank Piro.

Betty Lloyd turned to Teresa Stone. It was a time for small talk, for any talk to stay away from what had brought them here.

"How are the children, Teresa?"

"Fine."

Betty nodded, almost absent-mindedly, as if the conversation could go on without her active participation. "Mine are all studying for exams. The high schools certainly put on the pressure these days."

"Yes. I imagine they do." Teresa wished Betty would be quiet.

Several astronauts approached. They recognized them.

"Why, hello, Mickey," Betty Lloyd said, holding out her hand. "How are you?"

"Fine, honey. How you doing?"

Celia Pruett's face showed interest. "Pete. I'm glad you're here. I thought you were in Hawaii."

"Flew back. Dick wanted me here." Celia Pruett nodded and squeezed his hand.

Wheeler came back to them. The astronauts moved away.

"I should caution you," Wheeler said to the three wives. "You're going to notice some degeneration. But it's important, very important, to show them how confident *you* are."

"We understand," Betty said quickly. "We won't let you down."

Celia Pruett's eyes narrowed. Wheeler didn't want to meet them.

"You want us to be cheerful," she said.

Wheeler turned his eyes to Teresa Stone. "The more relaxed they are," he said carefully, "the less oxygen they use."

He was getting little help from her. "I know why we're here," Teresa said disarmingly.

"Well—"

"You're letting us say goodbye."

A radio voice saved Wheeler.

"Guaymas reports contact."

"Roger. We've got them on the link."

Wheeler turned again to Pruett's wife. "Celia?"

He escorted her down the aisle to the CapCom console, to the desk adjoining that of Frank Piro. The big screen at the front of the room lit up with the ghostly face of Jim Pruett. Celia drew her breath in sharply as she saw her husband; haggard and drawn, dark spaces for his eyes. Jim's face loomed over her as she sat down near Frank Piro.

Piro studied her expression. He leaned forward to a separate microphone. "Kill the wall video," he ordered. "Give me video on the CapCom monitor only. Got that? Kill all other video. CapCom monitor only." The big picture flashed out.

"Thank you," Celia whispered. The monitor directly before her came to life. Her husband stared at her. If only he could see her face, too . . . She took a deep breath.

"Well, here I am again, hon."

"Celia. My God!"

His voice was so loud it rattled the speakers. Celia looked around wildly, frightened. "Christ! Sorry . . ." Frank Piro

shot out his hand, twisted the volume control. He turned away, trying not to listen. Celia forced herself to smile. It would be best that way. It would reflect in her voice . . .

"Everyone's been so nice, Jim. I talked with your father and he says hello. You know him. He said that would be a whole message for you. He, uh, had a cold but he's much better now. By the way, I bought some shoes like you told me. They hurt." She laughed lightly. Pruett couldn't see her biting her lip, couldn't see the crimson stain.

". . . and, I lost the bill for the insurance. I thought I had paid it and then just this morning, darn them, I got a letter—"

It didn't take. His voice came through hoarse. She could detect the personal torture in it.

"Listen, baby, I just wanted to tell you I love you and—"

Her knuckles went white. It was that something in his voice. *Oh, my God . . .*

". . . what?"

"I said I love you. I just wanted you to know."

"Oh." Her voice was very small. "I know," she said softly.

"I just wanted to make sure."

She felt the desperation exploding within her to talk freely with him, to tell him everything she felt, to let herself go. But she was trapped, pinned down, frightened of saying the wrong words.

"Darling?"

"Uh-huh."

"Is it very lonely where you are?"

"Not for long."

The words burst from her, blurting past her lips. "Jim, we all—all—believe they'll make it. Ted will make it, we're all so confident he'll—"

Pruett allowed himself a sardonic grin. He shook his head lightly as if enjoying an inner joke. "Celia, if you have any problems about the house or the insurance, anything like that, you talk to Dougherty. He's a good troop. You can depend on him."

She fought to keep the shadows from her face. He would see it in her words, the tone of her voice. Her knuckles were white.

"I gave him a kiss to give you when he sees you."

He laughed. Free this time. Open. "Just what I need." He rubbed his bearded chin.

She felt pleasure that he could laugh, that she could do this to, for him. She laughed with him.

"You never can tell."

He didn't answer. The silence held.

"I got to go now, Celia."

"No—not yet. *Please.*"

"Listen to me, Celia. I had a real good day today. When you think of this day, remember, I had a real good day."

She fought back the tears. The crimson was a thin line running down from her lower lip.

"Jim—?"

"We have to wind it up, kid."

She was desperate to say it, to hang on to the minutes. "But—Jim, there's one more thing I have to tell you—!"

She didn't know what to say in the renewed silence. She blurted the first words that came to her. "I—I lost five pounds last week, getting sleek for you. But I didn't lose any, uh, you know where. I—I can't wait for you to see me."

"Take care of yourself, Celia."

Her fingers touched his face on the glass.

"Take care—love."

Clayton Stone's face, close up, filled the screen. Teresa took a deep breath.

"Hiya, sport," she said.

"Teresa."

Just her name. It told her how bad it really was up there. He *never* used her full name unless . . . he always called her Terry. Not now.

"How are the mice?" she asked, forcing the lightness. She knew her falling apart could unhinge the man she loved.

"Learning something every day."

"You writing a big dull book up there?"

"Small, dull book. How are you, Teresa?"

It wasn't as bad as she . . .

"I've been working on a little project. I've developed an experimental hypothesis for you to prove out."

"Tell me what it is."

"I miss you like mad."

"Has my paper come out?"

"Yes, it's out. Do you miss me?"

"What were the comments on the paper?"

"Professor Stovall said it's a brilliant presentation but he's not sure you miss me."

"What were the other comments?"
"I love you, Stoney. *Oh, God, I love you.*"
"This is embarrassing, Teresa."
He's trying to hold on, you fool! Help him!
"Your paper was very well received."

Buzz Lloyd suffered through Celia Pruett and Teresa Stone. He couldn't stand it. It was like crawling around in the minds of his best friends and joining with them in this goddamned self-torture. Why the hell didn't they let them all just die in peace? For Christ's sake, all this . . . Then Stoney was through. Pruett was looking through the window by his couch. Stoney turned over and busied himself with some equipment.

In Mission Control Frank Piro, who checked each time to be certain both video and audio were clear, felt misgivings as Betty Lloyd came before the monitor. Buzz couldn't take too much, Piro knew. He was fighting visibly to keep himself under control. But his eyes were too wide and a muscle twitched steadily in his cheek. Piro glanced at Betty. At least, he noticed, she was doing her best not to be affected openly by the gaunt and beset face on the screen.

"And General LeClare called all the way from Clark Field, Buzz. I thought that was so nice."

"Oh. Oh, yeah. Sure—"

"They want to give you something, a scroll or a—"

He paid her words no attention. "You got to understand the way it is, honey. Everything is crapping out on us, you understand?"

"I understand, Buzz."

"See, I broke the washing machine and now I can't fix it."

"I understand how you feel—"

"I could fix it, all right, but they won't give me the tools. They want us just to lie here and—"

"Listen, honey, I wrote something this morning. We're all going to sing it. Can I read it to you?"

"What?"

She unfolded the paper, rushing, her fingers shaking slightly. She read:

"The President, The White House, Washington, D.C. Dear Mister President. We just wanted to let you know how much we appreciate the heroic action to save our husbands . . ."

"What the hell are you talking about?"

". . . are grateful to you and everyone in the nation. The

team effort of the past two days will be an inspiration to us, our children, and our courageous husbands. We—"

"Are you out of your goddamned mind? Don't you understand? It's all falling apart and they're blaming me. *Me!* And, I don't feel real good. I—oh, Jesus, I—I—"

She couldn't take any more. She moved the chair back and started to rise. "I have to go now, Buzz. I love you. See you soon."

She tore off the earphones and stood, clenching her teeth, breathing deeply. Frank Piro heard Buzz calling. "Betty! Where are you? *Betty!*" He didn't look at her as she moved away.

Someone—damnit!—hit the control for the big screen. Buzz Lloyd's face came on, huge, distorted. Piro pushed himself desperately into the gap.

"Buzz, Piro here. Can you give us a reading on your partial pressure of carbon dioxide?"

Betty Lloyd walked up the steps past the controllers. Her husband's voice crackled through the room.

"I just gave you that! What the hell do—"

"Ah, that's negative, Buzz." Piro kept his voice pleasant, unhurried. "You gave me a P.S.I. on—"

"What the hell difference does it make?" Lloyd shouted. "I want to know what the hell's going on down there!"

Betty stopped, turned around, saw his face on the screen, his eyes wide, his mouth working, the muscle throbbing in his cheek. Her face drained of color.

"When are you people going to get us out of here?"

Someone cursed and killed the big screen. The image collapsed and the screen went white.

She composed herself as best she could, still moving up the steps, then past the astronauts, along the front of the VIP gallery, toward the exit. She looked straight ahead as people inside the crowded gallery watched her as she passed.

There was no picture on the big screen. But the voices came through. She bit her lip, walking faster. The voices told her. She didn't need to see it.

Pruett was struggling with her husband.

His voice had become a scream of agony.

"Don't kill us down there! Don't kill me! I didn't do it! It's not my fault!"

"The hypo—quick!"

She recognized Pruett's voice.

"You goddamned—"

Buzz gasped as Stone slipped a needle into his arm. She could still hear the struggling.

"Just a few moments. He'll be okay in a few moments. Just hang on, Buzz. Hang on, fella—"

The last she heard as she ran through the corridor was the helpless sobbing. She pushed through the door to the parking lot, her heart hammering.

". . . my fault. My fault . . ." His voice trailed off and he went limp.

The big screen came alive. Pruett and Stone were strapping Lloyd to his couch. He was almost asleep from the shot.

"Ironman, Flight here! Ironman, Flight!"

Pruett's voice came back, savage. "Why'd you bring her there? Why'd you bring in his wife?"

Dr. Kortney rushed to a microphone by Piro's console. "You must keep him sedated, Jim. You *must* keep him away from the controls."

Pruett wasn't even listening. He was shouting now, his anger spilling over.

"Why'd you bring in his goddamn wife?"

Kortney chose to ignore the words. "He's dangerous, Jim. To himself and to you and Stoney. Do you understand that?"

"You just get that goddamned bug off the ground!"

He switched off all communications with the ground. In the ship he stared down at the unconscious Lloyd. Pruett's voice was infinitely tired.

"He's tired, that's all. The poor son of a bitch is tired. We're tired. Everybody's tired."

She held it back until she reached her car. Then the tears came. She heard his voice, over and over, and she saw his face, contorted, frightened.

"I don't understand," she whispered to herself, crying. "I don't understand."

Chapter XIX

Les Roberson tugged his hat tighter on his head as a sudden wind gust rattled through Press Site Three on Cape Kennedy. To his front and left loomed the slab-sided walls of the VIB where the Titan IIIC booster had first been assembled. The control room for the launch with Ted Dougherty inside the bright-red lifting body known as the X-RV was high up in the structure, facing the launch pad several miles distant. Roberson's eyes moved along the railroad tracks from the VIB to the SMAB, a goliath of a modern temple, and still further on to Pad 41, where the service tower surrounded the booster. The system was complete save for the X-RV itself, and the word had been passed to the press site that the big Sikorsky helicopter would be passing almost directly over the site on its way to the pad. It would be a hell of a ride inside that chopper, for the winds were rising steadily and the air was wicked with sharp gusts.

Roberson knew this better than any other newsman at the press site. Just an hour before, he'd landed in his own plane, broadcasting from the air, describing the changes already evident in the community areas surrounding Cape Kennedy. Hurricane Alma was still fairly well out to sea but the storm was picking up strength and pushing its way landward. The winds surrounding the eye were at eighty miles an hour, but what was worst of all was the ground track of the storm. In the entire history of the area, long before Cocoa Beach and the other communities in the area even had names, no hurri-

cane had ever struck directly from the east. Looking at things from the ground it was impossible to realize just how naked and vulnerable this place was. From the Cape on southward, every community perched precariously on thin strips of land barely above sea level, the ocean to the east and the sprawling Banana River to the west. With wind-driven waves coming from the east, piling up before the storm, much of the land area would disappear completely beneath water. Roberson flew down to Sebastian Inlet, some eighteen miles south of Cocoa Beach, where angry waves were smashing at the rock jetty and hurling spray over the high bridge crossing the inlet. For the first time in sixty years the cluster of fishing homes and other buildings at Sebastian were seriously threatened. Even at this point the area had been abandoned. Flying northward to Melbourne Beach, Indiatlantic, Indian Harbour Beach, Canova Beach, Satellite Beach, he came to Patrick Air Force Base. The military field, normally humming with aircraft, had been stripped of everything that could fly. The planes had been flown inland or to the north so they might survive the storm the winds of which were forecast at more than ninety miles an hour.

Most of Cocoa Beach was empty. The motels that lined the beachline—Quality Courts, Ramada, Holiday, Satellite, Howard Johnson's, Koko, Executive, Crossway, Astrocraft, Beach, Polaris—all these had already been abandoned. The others across the highway were largely empty. Every one of them would be flooded and only volunteer workers were staying on. Most of the apartment buildings were being emptied of their occupants, although many people in Twin Towers, six stories high, were prepared to ride out Alma with hurricane parties that would last for days. Some of the offices in the Cape Royal, ten stories tall, were already filled with laughing people who'd try anything—and they came prepared with sleeping bags, air mattresses, coolers filled with food and beer, and a variety of candles to fill the hours when the electrical power surely would be knocked out.

Les Roberson covered it all, and noted the stream of vehicles leading to the east and to the north. Most of Merritt Island was being evacuated, for once past the minor interference provided by the communities of Cocoa Beach and Cape Canaveral, the wind-lashed waves would tear across the shallow river, and the disaster authorities had predicted anything from four to eight feet of water in the housing areas. Roberson landed at Merritt Island Airport in a vicious gusting

wind. Several people held down the plane as he climbed out, turning it over to a pilot who would fly it several hundred miles away. From the airport he rushed to Press Site Three, where his broadcast trailer was already secured to the earth by long iron stakes hammered into the ground, and fastened with steel cable. This was going to be a beauty.

He would be going on the air in a few moments. The Air Force was standing by to notify them of the arrival of the helicopter with the X-RV slung beneath the machine. The signal came, and Roberson picked it up. He'd covered the space scene for years, but he'd never had anything like this on his hands before. All the way through Gemini he'd been here. He'd watched the two-man ships rifle into space and then, at night, watched the bright star moving in the sky that showed the spacecraft crossing back over the Cape. He'd seen robots on their way to Mars and to Venus and to planned orbits around the sun, he'd seen the robots and the manned vehicles on their way to the moon. He thought of the list—Delta, Minuteman, Atlas, Atlas-Agena, Titan II, Gemini, Saturn IB, Saturn V, Centaur, Titan IIIC, Polaris, Poseidon. But nothing like the ticking of the clock as they had on their hands right n—

With binoculars he saw the big chopper and its precious cargo and he went live with his broadcast. The Sikorsky came toward the press site from across the lower section of Merritt Island, over Newfound Harbor and the causeways crossing the Banana River. The red X-RV swayed in the downwash and the wind gusts, and as the helicopter swung around the VIB, passing almost directly over the press site, Roberson caught view of Ted Dougherty behind the controls of the clattering machine. Roberson broadcast it swiftly and with detail as the helicopter roared past the SMAB, drove through the air along the rail tracks, and eased the X-RV expertly onto a flatbed trailer waiting to carry it the last few hundred feet to the launch pad. He kept up the broadcast until he saw the spaceship on the ground and the helicopter lifting away. Then he grabbed his portable transmitter and ran to a waiting Air Force sedan. He wasn't going to miss a minute of *this* operation.

Although, he thought as he watched the clouds scudding low overhead, I wouldn't take any bets on Dougherty getting off the ground. Not when he had to lift off precisely on the launch window that matched the orbital flight of Ironman

One. They could launch the Titan IIIC in high winds, all right. But just *so* high and no higher.

And the way Roberson figured it, the way the storm was moving in and the winds were rising, they would be cutting it just a bit too thin.

Too thin, indeed, for three guys sweating out the countdown.

Les Roberson wasn't the only person with the rising winds uppermost in his mind . . .

Charles Keith watched Dougherty bring the big helicopter in neatly to the waiting trailer bed. He jockeyed the machine with infinite care. He knew better than anyone else that a single slip, one small error at this moment, could wreck everything they'd done until now. He played the chopper with steady, unvarying patience. He felt the load sling relax, got the signal from a ground controller to hover, and held the Sikorsky at the exact height, his hands and feet moving almost of their own accord to compensate for the winds. A hand waved him off and he backed the helicopter away from the trailer bed. A hundred feet down the road running parallel to the rail lines, he settled to earth, climbed out and ran to the truck. It was already starting to move. The hoist crew was ready and waiting to start it on its journey to the top of the Titan booster.

Dougherty climbed into a car with Keith and Ike Saddler. The colonel had a look of amazement on his face. "My God, only thirty-six hours and fifteen minutes. This is incredible. Why—"

"Give me a status report on the booster," Dougherty snapped. The kudos could come later. They hadn't saved a single life yet.

They gathered around the center worktable in the meteorology office inside the VIB. Strips of maps from weather satellites covered the table and gave a precise progress report of Hurricane Alma. In the background they heard, but ignored the voices on the wall speakers as the countdown progressed.

Dougherty turned to Keith. "What's the story on the hurricane? Those winds out there—" he left the sentence unfinished.

Keith gestured at the weather maps. "See for yourself. It's coming right for us."

Dougherty swore. "When did it turn?"

"Six hours ago."

"When do we get it here?"

"Winds up to ninety miles early tonight. Best guess is by nine o'clock."

Dougherty snatched up a chart and studied the markings. Keith in turn studied the astronaut. He saw anger appearing on Dougherty's face. Irrational—and unnecessary at this point—anger.

"Goddamnit, they said this storm was going out to sea," Dougherty snapped.

"It was. Now it's turned. Now they're wrong. Now it's coming straight at us."

The anger spilled over as Keith had expected it to. Good. Let him get rid of it now. Not later when he couldn't afford to be angry.

"How the hell could they make a stupid mistake like that?" Dougherty shouted.

Keith looked directly at him and his voice was quiet. "Listen to me, mister. Stop wasting your energy on something you can't control. A hurricane is a self-enclosed rotating low pressure system. It's mindless. It doesn't know them or you or me. It changed course once. It can change course again. I'm busy. And you should be."

He walked away from Dougherty.

Chapter XX

Def: TIME HACK A coordination of timing devices by the personnel of one or more ground reference and command facilities, sometimes with the personnel of an airborne or orbiting vehicle or vehicles; usually made to assure split-second timing of separate events at the exact same anticipated moment. Normally this leads to an event at this future instant in time among two or more objects and/or personnel. The activities leading up to the coordinated event are not necessarily related until the future anticipated moment comes to pass.

Seven hundred miles from Baikonur, Cosmonaut-Colonel Andrei Yakovlev looked down at the town of Panfilov, in the Sinkiang Province of Communist China. Soyuz XI hurtled through space and less than four minutes and 1,100 miles later the Soviet spaceman stared down and to the north at a serpentine line crawling across the surface of the planet—the Great Wall of China.

Fifteen minutes and thirty-one seconds exactly from the moment of liftoff at Baikonur, the spacecraft whipped high over Quemoy.

Sixteen minutes . . . The orbital line of Soyuz XI sliced along the northern edge of Formosa.

Twenty-six minutes . . . Yakovlev slid across the equator for the first time. The spacecraft pushed north of New Guinea, then north of New Zealand.

Sixty-one minutes . . . Swinging northeast, across the west

coast of South America, Soyuz XI raced up across Chile, Argentina, and Brazil.

Seventy-five minutes . . . In the radar tracking rooms at the Canary Islands, the Apollo network personnel made no move to track the thirteen-ton spacecraft that whipped overhead in silence. The station personnel knew nothing of Soyuz XI or of Andrei Yakovlev.

Thousands of miles from the Canaries, deep within rooms burrowed from the solid rock of a Colorado mountain, American and Canadian officers of Headquarters, North American Air Defense Command (NORAD) studied a series of flash radar reports. The SPADATS radar fence system had reported several passes by an unknown target which, from initial reports, must be in orbital configuration.

The men were puzzled. The orbit lay across an inclination of 47.3 degrees. There had been some unmanned Russian shots along here as well as a few scientific probes by the United States, but this one was *big* . . .

Seventy-seven minutes . . . Across the Spanish part of the Sahara Desert.

Eighty-two minutes . . . Algiers below.

Eighty-six minutes . . . Soyuz hurtled across southeastern Europe, bending in its orbital curve toward the east.

Ninety-six minutes . . . The first orbit ended and Yakovlev marked his log with the appropriate entry. The spacecraft plunged on and soon raced across the northern rim of the Aral Sea.

". . . Borisov speaking, Tadzhik. Come in, please."

"Hello, Vasily! Tadzhik reporting. Everything is going beautifully. Temperature is comfortable, cabin at one four point six and I have perfect readings for fuel, power . . . It is wonderful up here."

"Borisov to Tadzhik. Greetings from the Premier, Andrei, and all your fellow cosmonauts. Tracking has confirmed the accuracy of your orbital parameters. Prepare to copy when you contact Alpha."

"Very good."

"Tadzhik from Borisov. Your schedule calls for you to test the manual system on this orbit. Do you copy? Over."

"Affirmative—"

"Very good, Andrei. You will give a complete verbal report into your recorder, and initiate telemetry dump to Ocean Vessel Thursday."

Ninety-nine minutes . . . Across the edge of China.

One hundred ten minutes . . . Just south of the main body of the Philippines. Yakovlev studied the islands. The cloud cover was getting heavy. The cosmonaut prepared to test the manual controls. He scanned his panel, reached out to flick a switch. He looked at a rotating globe eight inches in diameter, a gold-black representation of the earth below. A crosshair target presentation and a small circle showed him his precise position at that moment over the planet. The globe turned slowly, in perfect coordination with the sweep of the spacecraft around the world. He rested his hand about the control stick and leaned forward for a clearer view of the optical orientation instrument with which he would determine the Soyuz attitude in relation to the earth.

He moved the black handle and the spacecraft responded instantly.

Studying the optical lens by the port, he rolled the spacecraft from left to right, then pitched down, continuing through an arc of 360 degrees, snapping the ship to a stop exactly on his original heading. The Soyuz was like a thoroughbred, sensitive and steady. Then he turned the spacecraft again, keeping the line of the horizon visible in the orientation system. He flew by feel, studying intently the concentric circle of the orientation system, matching his yaw with the plotting on the latticed glass, which served as a chart for his control and orientation.

One hundred eighteen minutes . . . South of New Guinea, running to the southwest. Over Cape York Peninsula, Australia.

One hundred twenty-eight minutes . . . Yakovlev began a slow, spiraling motion of his spacecraft. Soyuz crossed the northern part of New Zealand.

One hundred thirty-two minutes . . . Yakovlev spoke steadily into the cabin tape recorder, and switched the telemetry transmitter to Standby.

One hundred forty-seven minutes . . . In its northeast run across the Pacific Ocean, the Russian spaceship passed north of Woomera. Ironman One, unknown to its occupants, had begun to parallel the Soyuz orbit, but the American spacecraft moved far to the northwest, sliding up for a pass across the area of the Panama Canal.

One hundred fifty-seven minutes . . . Soyuz XI crossed the equator over northern Brazil and swung to the northeast.

One hundred seventy-six minutes . . . Across northern Spain. Yakovlev completed another entry in his log, after

cross-checking the navigation globe with reference to stellar coordinates. Everything moved with extraordinary precision.

One hundred eighty-five minutes . . . The German border passed. Soyuz bends eastward in its orbit before commencing the swing to the southeast.

One hundred eighty-nine minutes . . . Iran.

One hundred ninety-four minutes . . . Moving southeast, toward the northeast coastline of India. At this moment Ironman has begun to slide across the earth at a slight angle to the Soyuz orbit. The path is more easterly, but roughly parallel to that of Soyuz. Ironman will make its pass directly beneath the southern tip of India.

Two hundred five minutes . . . Over Derby on the northern coast of Australia. Soyuz pushed over the Woomera tracking station. Tracking personnel, alerted by NORAD, were ready and waiting—

"Got 'em! Clean as a whistle on the scope! No transponder but look at the goddamn skin bounce from that thing. It's at least as big as Ironman—"

Two hundred seven minutes . . . "Woomera CapCom to Ironman. We think you've got some company up there with you. Do you copy?"

"Yeah, we got that. Company, you said? Any ideas—"

"Negative at this time, Ironman. We have celestial coordinates for you to try to sight the bogey visually. Radar has confirmation of target now parallel to your orbit."

"Okay. Ready to copy."

"Roger, Ironman—"

Pruett got his binoculars. The glasses were 6 X 25 power with a field of 11.0 degrees. If there were something out there he should be able to see it moving against the star field. He checked the coordinates again and—

"We've got him, Flight. Can't see too much. Looks like something with wings or panels. Could it be one of the old Pegasus satellites?"

"Negative, Ironman. No Pegasus satellites are currently visible from your position."

"Well, the mother is big, whatever it is."

Two hundred fifteen minutes . . . Woomera radar has lost tracking contact with the unknown spacecraft.

Two hundred sixteen minutes . . . "What do you think, Stoney?"

Stone looked at him from bloodshot eyes. "Obviously it's not ours," he said drily.

"Which means," Pruett came back, "that it's got to be one of theirs, right?"

"Yeah."

"Got any ideas, Brain?"

"I don't want to bore you with orbital mechanics."

"Just the ideas, Stoney." Pruett couldn't help the grin on his face.

"It *could* be," Stoney said carefully. "Let's see if we can get some tracking coordinates. If that son of a bitch is in position . . . Jesus, I don't know. I don't want to build up my hopes. You know what I mean?"

"I know. You're right. Let's save the conclusions till we see what the tracking net has to say."

Stone glanced at the sleeping form of Lloyd. "Want to tell him?"

Pruett shook his head. "Let the poor bastard sleep. Why get his hopes up?"

Two hundred forty-one minutes . . . Soyuz XI has rushed northeast, along a path south of Central America and west of South America. Ironman has swung well to the north, positioned west-northwest of the Russian spacecraft and due south of California.

Two hundred forty-three minutes . . . American reporters in Moscow have received uncounted shrugs of official Russian shoulders, complete with blank expressions and the repetitive monotone: "We know nothing of any new Soviet spacecraft in orbit."

No one believed them, of course. The truth was, strangely, that they did *not* know, because General Karpenko had ordered a strict blackout on any news about Soyuz XI or Andrei Yakovlev.

Colonel Harrison R. Townsend, Information Officer for NORAD, had been shouting into telephones. He interrupted another shrill ring almost as quickly as it started, listened only for a moment.

"No!" he shouted again. "I tell you that NORAD does not and *cannot,* by DOD order, give out any information on tracking. *No!* I'm sorry, but those are our orders. All information must come from NASA in Washington.

"What? How the hell do I know?

"Mister, I can't help it if they insist they don't know anything about a Russian spaceship that's orbiting right now. *Officially,* we don't know a damn thing either!"

He slammed down the phone, cursing as he pinched a finger against his desk.

Two hundred sixty-five minutes . . . Pamela Dougherty dropped a tray of dishes and cups. For a long moment the breaking china rattled on the floor as her hand flew to her mouth and she gasped. She rushed to the radio and turned up the volume:

". . .-etin has just been released by the national space agency. Astronaut Ted Dougherty, close friend of Jim Pruett marooned in space with two other men, will soon attempt a dramatic rescue of his friend. NASA reveals that the rescue spaceship, an X-RV lifting body, is already installed above a Titan IIIC rocket booster at Cape Kennedy, which is now being lashed by an approaching hurricane. Time is running out for Pruett, along with Lloyd and Stone, and Dougherty has only a slim chance to accomplish what would be the most sensational mercy mission in history. The launching is expected within hours. If the tremendous odds can be overcome, then Dougherty will bring back the three marooned astronauts in the X-RV lifting body. Space experts note that the X-RV has never flown in space and that Dougherty is relatively unfamiliar with the new spacecraft. Besides, the winds are rising dangerously at Cape Kennedy, and many people feel a launching under those conditions would be suicide. Rumors are still flying thick and fast about that mysterious spaceship that went into orbit a few hours ago. There is no question but that . . ."

She sagged weakly against a wall. So it was true! She'd heard the stories but had discounted them. Ted was going to —But the X-RV wasn't supposed to be ready for months! He had told her so himself; he had shouted about the program delays—and now he was going to ride that thing after Jim and the others, and . . .

"Mother of God," she whispered, *"it's too soon, too soon, it's all coming so suddenly."*

Two hundred seventy minutes . . . Soyuz XI crossed the French coast at Normandy, moving east.

Two hundred seventy-six minutes . . . The Black Sea below.

Two hundred eighty-three minutes . . . Persian Gulf.

Two hundred eighty-eight minutes . . . Soyuz crossed the equator south of Ceylon. Ironman is directly southwest of

Soyuz; orbits start to converge as they move rapidly toward Australia. It is the fourth orbit for Soyuz XI.

Two hundred ninety-five minutes . . . Muchea radar in Australia reported that the Russian spacecraft had performed an in-orbit maneuver. The perigee now matched that of Ironman.

Three hundred three minutes . . . Muchea radar scopes have lost the mystery spaceship.

Three hundred eight minutes . . . Woomera radar lost the "bogey" as it swung south of New Zealand, curving into an east heading before beginning the orbital run to the northeast.

"Keith? This is Halliday at Goddard. I—"

"Can it wait, Phil? We're running out of time here, and—"

"No, it can't wait. We believe you should have our opinion right away. I'm sure your own suspicions will lead to the same conclusions, but we had to call."

"Go ahead, Phil."

"The long and short of it is that we're convinced the Russians are about to make their play. There seems little doubt that the Bolshies have put up a Soyuz with a transstage of some sort or another. We're convinced they're going to make a plane change and try to come out of it on the same inclination as Ironman, and—"

"When?"

A moment's hesitation.

"When, Phil?"

"On the pass coming up."

"That's less than thirty minutes from now!"

"I know. That's why we called you."

"Phil, how sure are you?"

"Sure? We're not *sure* of anything. But those people work within the framework of the same physical laws we do. And the pass over the Cape that's coming up now simply works out to the most efficient point in space and time to effect the plane transfer. They won't have this chance again for quite a while. Now, even if they don't get too close to Ironman, something we should expect, just as long as they're in the same plane, they *can* catch up in a few hours. It won't be any trouble then. The big thing is the plane-change maneuver."

"That would mean a rescue, wouldn't it?"

"It *could.*"

"Our count is right on the nose, Phil. But we've got that

storm moving in here and—damn, we can't tell our people *not* to cooperate with the Russians. This may be their only chance. Phil, put someone on this line and keep it open. I'll do the same here." Keith spun on his heel. "Novak! Mac, and you, too, Blake. Over here by my desk—hurry."

Three hundred sixteen minutes . . . "Tadzhik to Ocean Vessel *Lenin*. You're coming in clear now. My condition is excellent and the spacecraft is running like a fine watch. I am ready now to begin the count for the transfer maneuver. Do you copy? Ready for the count into the transfer maneuver. Estimate transfer in two seven minutes. Over."

"*Lenin* to Tadzhik. Very good, Comrade! We are ready for the checklist. Transstage pressure switch to—"

Three hundred thirty-five minutes . . . Soyuz XI is west of Panama, over the Pacific. Ironman at this moment is almost due west of the Russian spacecraft. On a plotting board showing the present orbits and positions, drawing the orbital lines ahead in space and time, it is clear that the two spaceships will come very close together during their pass over Cape Kennedy. Soyuz begins its run directly over Guatemala and Yucatan, moving northeast.

Three hundred thirty-nine minutes . . . Cape Kennedy radar picks up the Russian spacecraft.

Three hundred forty minutes . . . Andrei Yakovlev glances down at the edge of Cuba. *There is America, only seconds away. We shall know soon enough* . . .

Three hundred forty-one minutes . . . Soyuz XI reaches the southwestern coast of Florida. It starts a run over the Okefenokee Swamp.

The enormous area is hushed. There are thousands of people, of every description, standing crowded into the huge structure. The waiting room of Grand Central Station has been transformed. It is almost like a cathedral.

They stand in a great mass throughout the high-roofed room. They stand on the marble stairs leading to the upper levels and Vanderbilt Avenue. They stand in the entranceways to the train platforms, they are crowded onto the space where a new car is on exhibit, and they sit and stand on the shiny metal without knowing or caring what they do. The newsstands are still and they do no business, for the men behind the racks of papers and magazines, like everyone else in

that vast space, are staring at a green screen, staring at a picture that is shadowy and that could be clearer.

They stand and look at the faces of the three men who are uppermost in their thoughts. They are looking at the interior of Ironman One, looking at a screen that shows them a scene flashed to an electronic station on the Pacific coast and transmitted, instantly, to here. Beneath the pictures of the men named Pruett, Lloyd and Stone, glowing letters slide silently from left to right, a continuing series of bulletins on the grim drama being played in the unimaginable vacuum so far above them.

They see Pruett's lips move, and each in his own way finds identification with that man. None of these people know Pruett, or Buzz Lloyd, or Clayton Stone, and yet, strangely, each feels, with full conviction, that he knows them all.

A woman, young and attractive, holding a small child by the hand, is the first. Standing in a small space, uncaring about those about her, she kneels. The floor is hard and it is cold, but it doesn't matter. She kneels, and she bows her head, while the child stares at her in wonder.

A man watches her. His lips are pressed tightly together, almost white. He removes his hat, and then he too kneels.

A porter holds his red cap in his hands and moves to one knee.

A man in an expensive suit kneels alongside him.

A small group stands with heads bowed.

A hundred . . . then six hundred . . . and a thousand, and hundreds more, and still more—pray.

A distant rumble of thunder moves beneath them as a subway train groans into life.

No one listens.

Three hundred forty-two minutes . . . Soyuz XI passes the east coast of Florida, just south of Cape Kennedy.

"Well, the pattern is clear now. See those tracks?"

Two intersecting lines, two glowing dots on a screen in Mission Control.

"You can just about see it happening. The Russian *must* make his move any moment now. Their ship is only several minutes ahead of Ironman. If they're going to play the game, now's the time for it."

Three hundred forty-two minutes forty-five seconds . . .

The men in Baikonur are silent. They are frozen into their seats or where they stand. All eyes are turned to a large sweep-second hand.

General Karpenko murmurs, "Fifteen more seconds—" His voice is a whisper; he doesn't realize he is counting aloud. "Fourteen—thirteen—twelve—"

Three hundred forty-two minutes fifty-six seconds . . .

"Bermuda radar has a definite return on the Russian ship—"

Three hundred forty-three minutes . . .

Andrei Yakovlev watches the numbers flashing in reverse in his instrument panel timer. At *three* he tenses; at *two* he holds his breath; at *one* his hand starts to move; at *zero* he makes the move for which he has waited these 343 minutes.

Chapter XXI

An Air Force sedan, red light blinking furiously, pulled up in the driving wind alongside the door to the checkout trailer on Pad 41. Charles Keith went directly to the door, banged his fist on metal, and climbed inside as an air policeman swung open the door for him. Immediately the door closed. Keith stood for several moments to accustom his eyes to the light. The entire length of the trailer was jammed with checkout consoles; hundreds of lights read green or amber. Keith looked over the shoulders and heads of the technicians packed together, working their individual panels. Finally his eyes stopped on a single red light.

Two technicians joined him. For several seconds the silence held as Keith examined the panel. Finally he had the information he required.

"Have you run a test cycle?" he asked.

The first technician answered at once. "Yes. It all checks out."

"Computer check?"

The second man answered. "Sir, that will take another two hours at the minimum."

Keith stared at the red light.

"It's not in the computer, Mr. Keith," said the first man. "It's in the bird."

Keith didn't answer immediately. A speaker on the wall came to life. "This is launch control. T minus fifty minutes. Verify all vents and pressurization umbilicals."

Keith thought about the count, the red light glaring at him, Dougherty high above in the X-RV, on his back, working with the White Room technicians on the final checklists.

Again the speaker: "Verify destruct initiators."

Keith tapped a man on the shoulder, took his earphones, sat before the panel with the offending red light.

Again launch control: "T minus forty-one minutes."

Keith looked up finally and turned to the technicians standing behind him. "It's not in the bird," he said flatly.

"But—"

"It's in the computer."

"Christ, I don't think so, Mr. Keith. I really don't."

"Is it too late," the second man added, "to go out and fix it?"

"Too late?" Keith echoed. He rose to his feet, turned two knobs and yanked a solid-circuit module from the panel. The red light went out.

"It's fixed now," Keith said.

They watched him leave the trailer.

"Jesus," the first technician muttered.

Right fist gripping the black handle, Andrei Yakovlev nudged the spacecraft about until the Soyuz pointed along a new heading. The blunt nose of the ship was now locked to an azimuth of exactly 130 degrees. In effect he was flying sideways, as much as 82.3 degrees from the angle at which his vessel had sliced across the equator. The proper heading assured, he locked in the autopilot for his yaw mode. The electronic brain would now hold the new heading while he continued his remaining preparations. Again the gleaming black handle moved beneath his skilled hand. Open ports in the nose of the Soyuz spat flame. He overshot; the nose of the spacecraft dipped seven degrees lower than the setting he desired. More carefully now, he brought up the nose until it hung several degrees below the horizontal plane reference of the earth. Quickly he activated the autopilot mode for pitch, effectively slaving the yaw and pitch axes of his spaceship to the electronic brain and its attitude sensors. From this point on, Yakovlev would function as a human backup to automatic control; he would interfere with the robot sequences only in the event of any discrepancy. His eyes flicked over the controls and gauges. He made a minute adjustment to the master control for the ullages and readjusted for the timer for the transstage engine. The minutes fled; seconds re-

mained. Aloud, he counted the fleeing of time. A red light gleamed brightly and his lips moved:

"Dye'syat
"Dye'vyat
"Vo'syem
"Syem
"Shyest
"Pyat
"Chyetey'rye . . ."
More lights flashed on . . .
"Tri
"Dva
"Odin!"

He was ready and waiting; Yakovlev snapped the switch hard over to the left. He heard very distant thunder as the ullages ignited. Three seconds after the first rumble a tremendous blossom of flame erupted behind the Russian spacecraft.

A huge fist slammed into Yakovlev. From near-weightlessness of the ullages he was pounded to an acceleration of 2.88g; his body weight shot painfully to nearly 500 pounds. A crashing waterfall slammed against his ears; he smiled with the sound of the transstage engine. He tasted salt; surprised, he licked his lips and discovered that in the acceleration he'd bitten his lip deep enough to draw a trickle of blood.

Pushed into his couch, he kept his hand ready to shut down the transstage engine. His right fist gripped the black control handle and his thumb was ready to switch instantly from automatic to manual control. Before him, seconds flickered out of existence on the timer that counted backward. At 50.5 seconds exactly the engine should quit.

Everything now must happen with exacting requirements of celestial and orbital mechanics. Soyuz must maintain precise azimuth and pitch, with any rolling tendencies immediately dampened out. As it maintained these axes of control, the spacecraft must gain a Delta V of 6,500 feet per second. At burnout the acceleration gauge would show a reading of not quite 5.5g. The clock came around to 50.5 seconds, the reverse timer flickered to zero, the accelerometer nudged a reading of 5.43g—and Yakovlev was hurled back into weightlessness.

His body trembled from the rapid onset and decrease of forces. He sucked in deeply of air and blinked his eyes. His

finger flicked toward him. Once again he felt and heard the cues of activity: popping sounds as explosive bolts cracked from behind him, freeing the connections of his ship to the now empty transstage; then a crackling roar from four small rockets that pushed the Soyuz away from the useless shell behind him. Quickly he stabbed down with his thumb to regain manual control, pitching up and bringing in roll so he could visually follow the receding transstage. He counted to himself.

Eight seconds later he watched a small blossom of flame appear along the shell of the empty rocket. The transstage moved rapidly away, sliding off at an angle that would take it well clear of his own path—and that of the Americans', he reminded himself—in the coming orbits.

The radarman breathed slowly. Then his breath exploded out. "Did you see that change? Good God, *he's done it!* He's shifted completely to the Ironman plane—and he's right on the button!"

The Bermuda radar scanned the black heavens. The invisible beams flashed out and back with the speed of light and . . .

"We're getting a split on the scope. That's right; uh-huh—we can get separation to thirty yards or so. What? It must be that transstage he used; it's cutting off at an angle. No, no. From the way it looks here, it won't go into a separate orbit; no really. It should swing out at a hell of a tangent, though.

"Yeah, Goddard should be giving Cape Control and Houston the news on both of them. Wait a moment—we're picking up a couple more on the scope. The return is weak on those. It must be the interfacing clamps. Probably explosive separation. Just some small junk. Yeah—affirmative on that, too. They're moving out pretty well from the main target.

"I'll say he is! From first indication he's as clean on the Ironman track as though we put him up ourself. That must be one hell of a piece of machinery up there."

Soyuz XI was in its new orbit. Soyuz and Ironman orbited the earth along exactly the same inclination to the equator. The shift of the Russian spacecraft had modified the orbit until—as the Bermuda radarman noted—it seemed as if it had been launched from the same pad that originally spawned Ironman One.

Once again the Soyuz had moved closer to that planned goal of a convergence in space and time. The perigee of Soyuz and Ironman were now virtually identical. But its apogee was not the same. It represented a major—and deliberate—difference. The stage, however, has been set with exquisite planning. The movement of the two spacecraft toward one another is now a matter of orbital mechanics. The Russians have adhered to physical laws with splendid discipline and now they are prepared to have those laws work in their interest.

The period of each orbit, the time to circle the earth, must be judged while using the earth as a base reference. This is the earth-based orbit, which considers both the surface of the earth and the vital fact that this surface is rotating at a specific speed.

In this orbit the perigee of Soyuz and Ironman are the same. But the apogee of the Russian spacecraft is higher. Andrei Yakovlev will require almost two minutes longer than the Americans to complete one full global passage.

The discrepancy in time is quite deliberate.

Soyuz and Ironman are still some distance apart. If the Soviets have prepared their blend of orbital mechanics with exacting thoroughness, the next swing around the earth will eliminate the difference of two minutes in their passage over the same point on the ground. Andrei Yakovlev bides his time. Things may be slightly less than perfect. That's why he has two thousand pounds of in-orbit maneuvering fuel.

"What's the story on that Russian ship?"

"He's made the change, Dougherty."

Dougherty thought over what was happening up there in orbit. Keith was on the other end of the line. "How close is he to Ironman?" Dougherty asked.

"It looks like identical inclination. Far as radar can tell yet, they've got the same perigee in the Bermuda area."

"What else?" Dougherty pressed.

"We're not certain about the apogee except that it's quite a bit higher, and—"

"It figures they'd do that. He can always fire into retro and slip into a pursuit mode."

"He could," Keith admitted. "But we don't know how much fuel he has, how good he is, and we haven't refined the orbital period differences yet."

"They've done a hell of a job with the Soyuz."

"I'm hoping just like you, Dougherty. If you're through with your questions—"

"I'm ready. All I'm doing is waiting here. You in contact with Ironman?"

"Forget Ironman, Dougherty. Forget that Russian ship. Forget everything but what you're doing."

"Roger."

They heard launch control pick up the count . . .

"Tower clear."

"There it goes," Dougherty murmured. His hands moved within the gloves, flexing around the controls. The seconds swept by.

All of them dragging, laborious, moving too slowly . . .

"Spacecraft to internal power."

"Roger," Dougherty confirmed.

The tower was well clear now, moving to its lock-and-hold position. With the protective mass gone, Dougherty felt the wind trembling in the spacecraft.

"All personnel clear the launch area. All personnel clear the launch area."

In the launch control room high within the VIB, the object of intensive study was the wind gauge. The needle held at thirty-five miles per hour. Then it trembled toward thirty-six. Outside the windows, rain lashed the Cape. Charles Keith paced the floor like a prowling animal, hands behind his back, staying clear of the launch crew but watching their every move.

"T minus sixteen minutes and counting."

The needle flicked to thirty-nine miles per hour, dropped back to thirty-six.

"Transponder is go."

Lightning ripped the sky.

"T minus thirteen minutes and counting. Can you verify C-Band?"

"Roger."

The needle pegged at forty miles per hour.

"T minus eight minutes and counting."

"T minus six minutes and counting."

"Roger."

"World net is go."

"Roger."

"All points to channel two for final status check."

"Roger."

The needle trembled at forty-two miles per hour.

"T minus three minutes and holding. This is a built-in hold."

"Roger."

The needle went to forty-three.

"We are ready for the final update to the spacecraft."

"Roger."

"Launch control, this is Houston."

"Go, Houston."

"Roger, Launch. Ask Rescue to prepare to copy."

"Dougherty here. Go ahead, Flight."

"Roger, Rescue. Address sixty twenty-four ninety-seven. Address sixty-one thirty-five sixty-seven . . ."

". . . just gone into a planned hold in the countdown at T minus three minutes. That's three minutes and holding, the hold built into the count for final updating of the launch system. Right now Ted Dougherty in the X-RV atop the powerful Titan IIIC booster is receiving his final mission coordinates from Mission Control at the Manned Spacecraft Center in Houston."

Les Roberson took a deep breath, turning his face away from the wind that sent rain slashing at his skin, penetrating through his raincoat. Along the row of telephone and broadcast booths, other newsmen huddled for slight protection in what had already become a howling gale. Until a few minutes ago they'd remained within trailers and cars for protection. Most of them still were there, waiting for the last seconds of the count before rushing outside.

Roberson would have none of that. He'd been in this game too long to hide behind windows when a live bird was on the pad, fueled with explosive mixtures, the whole lot of it alive. He'd seen more than one booster tear itself apart before the count reached zero. The whole world hung on what was happening here and huddling behind glass just wasn't the place to be. His voice went from Press Site Three to a local radio station, broadcasting to the Cape Kennedy area, and from there it was fanned out to more than five hundred other stations around the country. When you were up against the wire you wanted a pro . . .

"Right now, several miles across the northern strip of Cape Kennedy," Roberson went on, "I can see the Titan IIIC and the red arrow-shaped wedge of the X-RV with Ted Dougherty inside, waiting for those final minutes to vanish. The en-

tire area is blazing with floodlights. But I've never seen anything launched in weather like this, not even the military shots with ICBM's. There's no two ways about it—this is raw and naked weather. The surface of the Banana River is boiling with waves whipped to a white froth by this wind, which feels as if it's doing almost fifty miles an hour right now. It's hard to tell because we're getting stronger gusts every minute. I don't think any of us can count on this shot going. Three men marooned in space are counting on Ted Dougherty to snatch them from the jaws of death but there's just so much the Titan IIIC and its payload can stand from the effects of these winds. Right now we're at the critical point and . . . We've just received word the count will be picked up in twenty seconds. At that moment we'll be three minutes away from the scheduled moment of liftoff. Three minutes of a race against the clock and the wind. Here it is. Three minutes and counting . . ."

"Range safety clears. Go."

"Roger."

"T minus two minutes and counting."

"Look at the goddamned wind . . ."

The needle flickered between forty-three and forty-four miles per hour.

Les Roberson reminded his audience, millions of people across the country:

The No-go point was forty-five miles per hour . . .

"T minus eighty seconds and counting. Core vehicle is go."

"Roger."

General Parker came into launch control, looked around for a moment, walked quickly to Charles Keith.

"The winds are up to forty-six. Do we hold?"

"We are in the green all the way. Clear to launch."

Keith pressed his lips together, shook his head. "No. We'll go to fifty."

Parker breathed deeply. "All right."

"T minus seventy and counting . . ."

The needle stood at forty-seven.

"T minus sixty-five and counting . . ."

A heavy gust slammed against the building.

The needle jerked past fifty-seven . . .

General Parker turned to Keith, the question clear in his eyes.

He saw the pain in Keith's face. His lips trembled as he forced out the word.

"Hold."

The launch controller reacted instantly. *"Hold! T minus forty-five seconds and holding. Repeat, T minus forty-five seconds and holding . . ."*

It was a scene of unreality. The exhausted men at the launch control consoles stared blankly ahead of them. It was too much to take. Not *now* . . . Several men swayed in their seats, anguish visible in their faces, their movements. Someone said, "No, no, no," a hoarse whisper speaking for them all.

Ike Saddler slumped in his chair as if struck a physical blow. Suddenly his fist slammed down on his desk top, scattering coffee cups and ash trays in all directions. No one paid him any attention.

Keith's voice cut into them. "Shut it down."

"Launch control to tower crew. Move in the tower."

The voice tore into them. They were tied on open line to Mission Control in Houston and when they heard the voice they winced.

"Houston, Ironman."

Pruett's voice . . .

At the press site, newsmen shouted into telephones and microphones and took off at a dead run into the wind, technicians trailing behind, all of them running for the VIB.

"Houston, Ironman."

At Mission Control in Houston and at launch control in the VIB, Pruett's face appeared on the video monitors.

"Houston, this is Ironman."

In Houston and at the Cape they stared dumbly at the video picture.

Dick Wheeler was the Flight Director. He reminded himself of this fact. This was his job. He took over CapCom.

"Ironman, Houston here."

"How we doing, Pappy?"

Wheeler tried to speak, choked.

"Hey, Pappy, how we doing?"

Keith knew what was happening to Wheeler. He heard the strangled sounds. He switched in to the CapCom circuit. It took all his energy.

"Ironman, this is Keith.

"The launch is scrubbed."

Chapter XXII

There was no immediate reaction. For long seconds the speakers hissed with the static between the earth stations and the spaceship falling weightlessly around the planet. For those moments no one knew what to say or what to do. Time hung suspended. Charles Keith had said what needed to be said. The truth. Brutal in its bluntness, but there was no alternative. Keith and the others with him watched Pruett's gaunt and bearded face on the video monitor. It remained frozen, expressionless for a time they could not count. Finally the commander of Ironman One sighed, a whispering sound that seemed to come from everywhere.

"Well, that's it then," he said.

Keith started to speak but Pruett's voice, after a momentary hesitation, went on. "I figured this might happen," said the man whose death, and that of his friends with him, now seemed all the more certain. "We've been watching the storm from up here. The eye is still out from the coast a bit but the whole area is completely cloud-covered. We can't see central Florida at all. Charles, how close did you get?"

Keith found it difficult to speak. Now that the worst was over he wanted only to go away somewhere, where no one knew him. He wanted to hide, to let the numbness be soaked out by sun and solitude. But he couldn't do that yet. He summoned an inner strength and his voice came through clearly, with the no-nonsense tone that was so characteristic. Yet his

voice, even if he remained unaware of the fact, was softer, more human than anyone had ever heard before.

"We got it down to minus forty-five seconds, Jim. The winds were at fifty-eight when we scrubbed. We tried to go at fifty. You know the—"

"Yeah. No-go's at forty-five. You were taking a hell of a chance even at fifty. But fifty-eight, uh-uh. Why kill Ted?"

Keith's voice came out hard. "Listen to me, Jim. We're not through and you're not counted out yet. We're still working on the engine. We haven't studied everything yet and we'll stay with it, until—" his voice trailed off.

The image of Pruett's face on the monitor began to sag out of shape, flickering rapidly, as the signal weakened. But his voice, tired and worn as it was, came in clearly, and the men who listened knew they would never forget those words.

"Charles, I—we've got something to tell you. We know this business and we know what you've been doing. You've done a great job. Really. Every last one of you down there. You've all worked your tails off for us and we appreciate it. If our positions were reversed we couldn't have done any more. We wanted you to know how we feel. We wanted you to . . ."

Distorted image and voice sighed away as Ironman drifted away from the nearest tracking station. The screen went blank and there was again the hiss of static.

"Launch, Houston here. Hawaii has loss of signal. California will acquire in three minutes. Shall we remote you through?"

Keith stared at the blank screen. With an effort he started to move. He remembered the question.

"No. No remote."

The speakers on the wall came alive.

"Move in tower. Set up White Room. Move out, you people, and get the pilot out of there."

They turned to the speakers. They'd forgotten Dougherty for the moment, sealed within the lifting-body spacecraft. Before anyone spoke, the speakers rattled in their mounts.

"I'm not leaving this ship!"

"Insertion team to the White Room. On the double. Insertion team to the White Room. On the double."

"Where's Keith? Goddamnit, put Keith on! Get me Keith!"

Keith felt the blood draining from his face. His expression frozen, he turned back to the launch controller's console and picked up the microphone.

"Dougherty, Keith here. The team will be there in a few minutes to open up the ship."

"Go to hell. We came here to launch, remember?"

"Dougherty, we did everything that was humanly and mechanically possible, but we cannot launch in these winds."

"It's my ass that's in this ship, not yours."

"That can't affect the decision we—"

"I'm telling you to launch, goddamnit! There's three people counting on us up there!"

Keith closed his eyes. His hand shook with the terrible effort to maintain control. Goddamn Dougherty . . .

The words came out mechanically, spaced apart, each word separate.

"We—just—couldn't—make—it."

He walked from the launch control room, past the silent controllers. He had to get out of the building, get downstairs, get out into the damn storm, feel the rain and the wind, let it cleanse him. Behind him, Dougherty's voice boomed and racketed through the room, chasing him down the corridor.

"Listen to me, you son of a bitch! They're going to die up there! Get this haywagon off the ground! Launch, damn you! LAUNCH!"

They were waiting for him at the bottom of the stairs, a mob of wet, tired, angry, puzzled newsmen. They'd run wildly from the press site several hundred yards away, spurred on by the sudden cancellation, anxious to get the words directly from the man who had ordered the scrub and with those same words hammered home the final nails in the coffin of Pruett, Lloyd and Stone. They jostled their way into the low bay floor of the VIB, talking among themselves, cameras and tape recorders ready. They knew Keith would be coming down these stairs, would have to pass this way, and this might be their only chance to get to him. While they waited, several men were broadcasting live. Others were recording their words on tape, reviewing what had happened, what it meant, what would happen. The milling interview with Charles Keith would wrap it up. And while they waited they used the minutes to get it all down or to get it out live.

Les Roberson listened to Roy Cannon. The television reporter had flown to the Cape area just before the rising winds closed down the local airfields. He came down knowing little about the hardware involved in the program and even less about the men and virtually nothing about the real-

ity of the situation. Roberson listened as Cannon pontificated. The thought that millions of people would be listening to this pompous ass with a microphone turned Roberson's stomach.

"There are hard questions that need to be asked here," Cannon was saying. "Hard tough questions about priorities, about the need to risk men's lives in space when there's no real underlying reason for such wasteful extravaganzas. There are questions not only about why this launch was called off at the last moment, but whether it should even have been attempted in the first place. When thousands of people are killed every year on highways, was it worth so many millions of dollars in a long-shot effort to save three men already as good as dead? Those astronauts knew the risks they were taking. They knew they might be killed. This tremendous waste of effort to which we have been witness—"

Les Roberson chewed his lip. He knew Jim Pruett, and he knew Dougherty, and a great many of the other astronauts. He'd known them for years. He thought of them in Ironman, and he thought of Dougherty tearing himself apart inside because of the scrub, and Roberson figured, what the hell, they can't answer this windbag so I better do it for them . . .

"Hey, Cannon."

Roy Cannon kept talking.

"Cannon!"

"Damnit, can't you see we're taping? Maybe you locals don't know how to do a job but—"

"Got something important to tell you."

"What is it? Quick, you fool. Keith will be here any—"

"It's your mike, Cannon."

"What about the mike?"

"Look, there's something wrong with it."

"There's nothing wrong with—!"

"Here. Let me show you." Roberson took the heavy microphone in his hand. "See? Right here?"

"I don't see—"

"Come closer."

Cannon moved closer, straining to see.

Roberson's wrist snapped. The microphone smacked Cannon in the mouth. Roberson heard metal against teeth. A nice sound. Blood spurted from Cannon's mouth and he gasped in pain and horror.

A reporter with Cannon pushed up to Roberson. "You can't get away with—"

"You want some too?"

"Now, look here—"

"There's Keith!"

Charles Keith came slowly down the metal stairs, Ike Saddler with him. The reporters shouted questions, then went silent as Keith stopped on the stairway and looked at them. He held his gaze.

"I have a brief statement," he said, his voice torn. "The launch of the X-RV rescue vehicle was scrubbed at eight forty-seven Cape time. The pad was shut down at T minus forty-five seconds when the wind velocity at the pad itself rose to fifty-eight miles per hour." He took a deep breath. "I have spoken to the President. I have also spoken with Pruett, Lloyd and Stone in Ironman."

A pause.

"This was a very fine effort on the part of all concerned."

Again the pause.

"Are there any questions?"

Roberson had only one question. The only one that really mattered.

"Mr. Keith. You say the launch has been scrubbed. Does this mean you'll reschedule at a later time?"

There was a flicker of recognition in Keith's eyes.

"We have no plans."

Someone called a question from the back of the group.

"Will there be another rescue attempt?"

"We have no plans."

"Can you tell us anything about the Russian ship up there with Ironman?"

"I can tell you only what you know. There's a ship up there. We do not know if it's manned. It has shifted the plane of its orbit. You already know that. Right now it is not in a position to rendezvous."

"Do you think the Russians will—"

"Anything about that vehicle is pure conjecture."

Behind Keith, several men were running along a corridor, running toward him. They were behind him, unseen by him as the questions continued.

Roy Cannon, a handkerchief in one hand, called out. "Doctor Keith, you say the men have been informed. Who informed them?"

"I did."

An Air Force major, one of the men who had been seen running along the corridor, handed Keith a slip of paper.

Keith closed his fingers on the paper without thinking, held it at his side as he responded to the questions.

Roy Cannon kept at him. "When you spoke to Pruett and the others, and told him the shot was scrubbed, what was their reaction?"

Keith's look was total contempt.

"Any other questions?" he asked quietly.

The major moved into the silence, tugging at Keith's sleeve.

"Damn, what is it?" Keith snapped.

"The paper—"

"I have it."

"*Look* at it, for God's sake!"

Keith turned, his back to the newsmen. They saw the major unrolling a satellite picture chart, still damp from the processing machine. "All right," they heard Keith say, his voice angry. "What about it?"

"The numbers—"

"What in God's name—" Keith's voice trailed away as his eyes scanned the chart. He glanced at the major, gripped his chart and took off quickly.

The reporters flooded around the major, pushing, shouting at him.

"What did you give him? . . . Are they dead? . . . What the hell is going on? C'mon—"

The major tried to hold them at bay, tried to answer the torrent of questions.

"I—the time—"

"What about the time?"

"The—the time of the next launch window is—"

"The hurricane—what about the hurricane? Has the hurricane changed course?"

"Will you give me a chance? The storm hasn't changed course. It's not that at all," the major explained, trying to demonstrate with his hands. "You see, it's the eye— The eye of the hurricane, it will—"

"The eye? . . . What about the eye? . . . What the hell is he saying? . . . Speak louder! . . . Where's the eye of—"

"—pass over the Cape at the same time as the new launch."

They broke in a mob for the press site to get to their phones and radio lines.

Charles Keith sat with a hastily convened group in the

Launch Control Room of the VIB. Outside, the storm increased in fury, the rain lashing the windows, the sky flickering with lightning. Several miles away, straight down the gleaming tracks, the Titan IIIC stood embraced by the protective work tower. The White Room, closing like two halves of a clamshell, covered the X-RV.

Dougherty was still inside. He had refused to come out.

With Keith in launch control was Colonel Ike Saddler. General Parker sat with them, as did Major Carp from the meteorology office. Dr. Michaels, who long before had trained and checked out the three men now in Ironman One, was sitting in as the representative for Dr. Kortney, still at Mission Control in Houston. Through the video monitors, Kortney contributed to the meeting, as did Richard Wheeler, the Flight Director. There was no video to the cabin of the X-RV, but Dougherty could hear, and could contribute to the meeting.

Keith went straight to the point. "I want every one of you to cut the mustard. All I wish to hear from each of you is yes or no, go or no-go." Keith glanced up and looked into the video scanner covering the table, knowing the men in Houston would see his face as if he were looking directly at them from their video monitors.

"Flight, do we have a launch window while the eye passes over the Cape?"

Dick Wheeler's face disappeared from the monitor. Paul DeGrote took his place.

"We affirm a launch window at twelve thirty-one zero-six. If you have the eye, then we're go."

"General Parker, can you launch the IIIC through the eye of the hurricane?"

"Well, our feasibility work-up shows a strong—"

"Blast it. Yes or no, Parker."

"Yes, sir. We can."

"Saddler, will this bird of yours be ready to fly at that time?"

"It's been kicked around by winds of eighty knots. We haven't inspected it. The data is a little too spotty for ground checkout to make a judgment. They won't commit."

"Then you decide. What's your judgment?"

"Mine?"

"Yes."

"Damn right she'll fly."

Keith turned to the weather officer. "Carp, do we have sixteen minutes in the eye?"

"Sixteen? No, not sixteen."

"Fourteen?"

"Well, we've been trying to get a prog chart from the computer, but the data points are—"

"What's your judgment?"

The major hesitated, then made up his mind. "Yes. You'll get fourteen minutes."

Bill Hudson was Titan IIIC Launch Controller. Keith turned to him next.

"Hudson, can you move that tower out of the way in twelve minutes?"

"The book says no. I say yes. You give the order and we'll move it."

"Flight?"

"Right here," Wheeler came back at once.

"Is the rescue vehicle go for Point Charlie?"

Wheeler's face looked at them from the video monitor. "Affirmative. We can hit Point Charlie. But from there on the pilot will be on his own."

"Rescue?"

"Go," said Dougherty.

"Rescue, can you rendezvous without a program in your onboard computer?"

The wall speakers came to life.

"You just get me in the ball park. I got my relative motion plot, my mark one eyeballs and a lead pencil and that's all I need."

Keith looked around the room. "All right, gentlemen. Then we are go for launch at twelve thirty-one zero-six."

Keith rose to his feet. The others in the room left. Wheeler's face disappeared from the monitor. Only Dr. Michaels remained at the table.

"You know, of course," he said slowly, "that by twelve thirty-one the crew will be dead."

There was no answer.

"Men have to breathe, Mr. Keith. There isn't enough oxygen for three men to live that long."

The answer was long in coming. There was no question but there had to be an answer—in the form of a question.

"What about two men?"

"We don't plot that way. You know that. We plot total pressure against total use."

Keith's face was as hard as stone. "They told me to save lives. Lives I shall save. Now goddamnit, is there sufficient oxygen for two men? Yes or no."

Michaels didn't answer.

"*For one?*" Keith hammered.

The man in the room with him closed his eyes. He thought of the three men he knew so well.

"Two—might just make it."

Chapter XXIII

Andrei Yakovlev snaps out bursts from his maneuvering engine. The Russian is methodical. He takes no chances. He knows he cannot overshoot the American machine, for he may lack fuel then to carry out any major corrections. The American spacecraft is a gleaming star in the distance.

Yakovlev glances at the glowing miniature globe on his instrument panel. The small circle in the center of the crossing lines is moving up on the east coast of Africa. Yakovlev frowns.

He is behind his schedule for moving in close to Ironman, to the point where he may begin the actual rescue operation. He turns his head to study the onboard radar display, stares at the gleaming red numbers in their separate windows and his eyes blink.

The figures in the small windows stare back at him. They read 986.

This should not be! He stares again at the glowing numbers and shakes his head slowly.

He has lost more than thirty meters in his last maneuvers!

Even as he studies the numbers they change. Soon they read a new figure of 1133.

There can be only one answer. As the two spacecraft swing around the planet, Soyuz still retains a slight superiority in perigee velocity. Now, pushing around the globe and soaring up toward apogee, the machines are naturally beginning to

drift away from one another. And Soyuz, Yakovlev knows, will continue to slide away from the target.

The American machine has a lower apogee; thus it will be moving faster through this part of the orbit. But once they are over Australia, both spacecraft will have reached their highest altitude. From that moment on, as the machines swoop down toward the earth's surface, Yakovlev knows also he will begin again to close the distance between Soyuz and Ironman. The Russian spacecraft will regain its advantage in speed, and with its increasing velocity it will push in closer to the other ship.

But what will be the separation and the rates? It is impossible for him to compute so complicated a series of events! If only the American ship had responsive radar . . . Forget that, he ordered himself; it doesn't.

Over the Indian Ocean, Andrei Yakovlev engages in a detailed conversation with a Russian tracking-communications vessel. The tracking radar will determine the exact separation between the two machines, observe their paths, and will be able to work quickly on the problem.

Yakovlev is angry when he rushes past communications range. The tracking staff could not so quickly provide him with the information he needs; the shipboard computer needs more time to digest the raw data. Yakovlev is instructed to contact Ocean Vessel Ormsk *after he passes Australia. The Indian Ocean ship will contact the global communications center in Russia itself. There will be plenty of time for the reply to reach the* Ormsk *and the answer to be relayed to the spacecraft as it comes within range of the Pacific tracking vessel.*

Yakovlev dismisses the matter from his mind until he can establish such contact. There is work to do in the meantime.

He glances at the radar display and curses. The glowing numbers read 1261. He is still drifting away from the American machine. It is of little importance right now.

Suddenly he is angry with himself. He has made an error that might have been disastrous. With scathing self-denunciation he notes that the switch for the maneuvering engine is still in the Manual Control position. A sudden movement of his hand and he might have wasted more fuel and added to the separation distance of the machines. Quickly he flicks the control to Standby, keeping the system pressurized and ready for instant use.

Yakovlev rolls Soyuz and feeds in a yaw maneuver, then

stops the spacecraft and switches to autopilot mode to hold his attitude.

He strains to see through the window.

There is no sight of the American machine.

For a long time two of them remained motionless. Buzz Lloyd stared vacantly at nothing. To his left, Jim Pruett glared at the instrument panel. Only his eyes moved. His face had frozen in that expression of anger long minutes before and it seemed only his eyes were alive.

At the far right of the command module, Clayton Stone propped his logbook in his lap, writing slowly and carefully, his lips moving in concert with the words as they appeared on the pages.

". . . anticipated cause of death will be anoxia . . . interesting way to go . . . brain becomes starved for oxygen . . . visual receptors are first to fail and produce visual blackout while brain is still conscious . . . motor nerves suffer . . . but there will be no pain . . . dizziness and increasing drowsiness are . . ."

"Ironman, this is Cape CapCom remoting through RKV."

Pruett moved his eyes but remained immobile. Lloyd remained frozen where he was, staring off into space. Stone paid the voice no heed. He kept writing.

". . . immediately before the final moments there is strong possibility of false elation as brain cells, deprived of oxygen, function much in the manner of alcoholic impression within the blood stream . . . false elation. Not bad . . . giddiness and feeling great . . . you laugh it up . . . remember the tests we ran on this in altitude chambers . . . start singing and shouting . . . happy . . . then the visual blackout and failure of foreparts of the brain . . . not a bad way to go, right? . . ."

"Ironman One, Ironman One, Cape CapCom through RKV, do you read?"

Stone released the pen. It floated before him, turning slowly. He paid it no heed. Suspending articles in midair had long since become second nature to him. He held up his hand, staring at it, studying it.

"Interesting mechanism, the hand . . . marvelous articulation . . . always wanted to make this a detailed project . . . study project . . . not that much data on the good old hand, eh?"

"Ironman One, Bermuda CapCom, do you read?"

He moved his hand from side to side.

"Ironman One, Kano CapCom, do you read?"

Pruett and Lloyd stared ahead of them.

"Ironman One, Coastal Sentry Quebec, do you read?"

Stone wiggled his fingers and smiled.

"Ironman One, Houston CapCom, do you read?"

"Ironman One, this is Houston Flight. This is Houston Flight. Do you read?"

Pruett stirred. His eyes moved without focus. For several seconds his lips came together, dry and chapped. He licked them slowly. "Wha? Wha' the hell do they want?"

"Ironman One. Keith here. Pruett, this is Keith. I want to talk to you."

Pruett forced his body to move. His hand floated before him, stopped, trembling. With renewed effort he moved his hand to the panel and hit the communications switch.

"I hear you. Whaddya want?"

"Jesus, I thought they'd never—"

"Pruett, I have some numbers for you. You ready to copy?"

"Huh? Oh, sure. Copy. Yeah."

"Pruett, the eye of the hurricane will pass over the Cape at twelve-sixteen tonight. That's sixteen minutes after midnight. We will launch Dougherty through the eye of the hurricane at twelve thirty-one zero-six. Rendezvous at one-seventeen. You should be ready for crew transfer at that time, at one-seventeen. Do you copy?"

"Shit."

"Ironman, do you copy?"

"I said shit."

"I heard you and I repeat, do you copy?"

"Quit playing games, Keith. We'll all be two hours dead by then and you know it. Lay off, will you?"

"You'll be dead if you continue using oxygen at present rates, yes."

Pruett glanced at Stone. The other man looked at him in silence.

"No way to cut down," Pruett said to the microphone.

"Let's think about it," Keith proposed.

Pruett tried to think. "We could lower the partial pressure again."

Keith's voice came from a million miles away. "No," he said. "We've examined that. It won't work."

"So why all the fuss? What the hell do you want from us, anyway?" The anger moved through him like a revitalizing force. "We're lying here like corpses! What else can we do?"

Keith's voice was like a slap in the face. "*Think.* Quit acting like a corpse. We're too close for you people to go out like this now. Think, man, *think.*"

Again Pruett and Stone looked at each other. Pruett's facial muscles began to work.

"All right," he said after the pause. "We've thought."

Keith spoke every word with infinite caution. "Are we talking about the same thing?"

Pruett looked at Stone. The other man nodded ever so slightly. Pruett gestured at Lloyd. "Later," Stone said. Pruett nodded and turned back to the radio.

"Yeah," he told Keith.

"Have you reached a conclusion?"

"No."

"You've got to decide among yourselves. Why don't you talk it over? If you could work out something, it would, ah, it would be helpful."

He'd never heard Charles Keith step on his own words before.

"We'll talk it over," Pruett said.

"Ironman, I must point out that to be effective you've got to take the—ah, the action immediately."

"Goddamnit, don't tell me what to do!" Pruett shouted. "We've taken your goddamn orders and done everything you've told us to do! And where the hell are we? From now on we're making our own decisions. Whatever we do, you're out of it. You got that down there? *You're out of it!*"

Charles Keith breathed a silent prayer. *I knew he was a man but I didn't know just how much . . . God watch over him . . . He even gave us the words . . .*

"Affirmative, Ironman. I appreciate what you're saying, Pruett. You're right, of course. It's all up to you."

"You got anything else?"

"Not at this time."

"All right. Would you repeat those launch numbers?"

"Launch at twelve thirty-one zero-six."

"Okay. Got 'em."

As though he had forgotten their presence, Pruett released his straps, leaned forward and switched off both TV scanners.

At Cape Kennedy, in the launch control room of the VIB, Keith sat motionless, staring at the empty screen.

Pruett turned to look at the other men with him. Lloyd's eyes were closed. Stone was back to his pad, writing.

"Launch at 12-31-06. Rendezvous 1-17. Four hours."

"You heard them?"

Stone looked at Pruett.

"Uh-huh."

"What do you think?"

Stone shrugged. "Through the eye of a hurricane, huh." It was both statement and question.

Pruett nodded.

Stone put his pen in midair again. "Son of a bitch." He grabbed for the pen, closed the point. "Four hours."

"Yeah."

"That's a long four hours, Jim."

"I know."

"We'll be pretty cold by then."

"I know."

They let the silence embrace them. Both men turned their gaze to Buzz Lloyd. His cheek muscle twitched.

"Buzz?"

"I heard."

"All of it?"

"I *heard.*"

"Okay."

Buzz opened his eyes wide. He looked at Stone and then at Pruett. "Let's get it out in the open, huh?"

No one answered him.

Buzz shrugged. It was more a tremor through his body. "I guess somebody's got to go," he said. Still no reply. "Well, it's what we're talking about, isn't it? One goes and two stay, right?"

They stared at him, at the naked thing he'd brought into the open.

"Well, how we going to do it?"

The silence rushed back in. Lloyd turned his head to left and right, looking at each man individually.

"No use wasting all that scientific training they gave me," Stone said after a while. "Let's do this scientifically."

They waited for him to go on.

"The two big guys throw the little guy out."

Buzz exploded in laughter. He gasped for breath, fighting for air while Pruett slapped him on the back.

"That—that's an idea you got there," he choked.

Again the silence.

"Well, what the hell?" Buzz persisted. "We got to do something." No answer. "We got to talk about it, don't we?"

"We could do it by chance," Stone offered. "I tear strips out of the pad. One short, two long. Guy with the short goes." His eyes closed painfully. "Goddamnit, we can't do that."

"No," Pruett said softly. "We can't do that. None of us would do it, either."

"Yeah."

"You're right. We're a bunch of sissies."

"That's us."

"Hey, what about the Russian?" Lloyd asked.

"What about him?"

"Where is he? I mean, is there a chance he might—"

"You hear anybody knocking on the hatch?"

"Not lately I ain't."

"Keith didn't say a word about him either."

"No, he didn't."

"That's out then."

"Looks that way."

They lay silently. The pressure began to squeeze.

Lloyd broke the new silence. "I do *not* want to lie here and die. I don't even care if I die any more. I'm dead. We're all dead. But I don't want to lie here like *this* and die."

"Listen," Stone said. "Figure the odds. Is there that much difference, three guys or two guys? That's crap. I say we double the pills and put ourselves out." He snapped his fingers. "Just like that. No talking, no moving, the pulse way down. Like three zombies in a row. Even when there's hardly any pressure there's still oh two molecules floating around in here. You can live longer than you think in a vacuum bottle." Suddenly fury spilled from him. *"For chrissakes, it's only four hours!"*

Pruett let him cool off.

"You're dreaming, Stoney."

No one said anything.

Lloyd pushed himself upright. "All right, I'll go."

No answer.

"Look, I know you want *me* to go."

Silence.

"I—I'm the weakest. I'm eating more oxygen than either one of you two."

Complete silence except for their breathing.

"Isn't anybody gonna say something?"

He spun away from them, burying his face so they wouldn't see the tears.

Snap.

Lloyd and Stone looked up as Pruett released his couch straps. Pruett turned himself around, braced his body and reached beneath the couch. He withdrew his hard spacesuit and stretched it out in the air. It floated, quivering gently. Pruett turned again and started to don the suit.

"I'm going out to look at the engine," he said.

He had both legs on.

"Get in your suits," he told them.

"You can't fix the engine," Stone said.

"What the hell do you know about it?" Pruett flared. "I don't know why I let them talk me out of it. Goddamnit. I should have done this two days ago. Now we're not gonna lie here and rot to death. *Get in your goddamned suits!*"

They all kept their eyes on Frank Piro. Throughout the Mission Control room almost all activity had ground to a halt. Piro fidgeted in his seat before his CapCom mike.

"Now we figure you've got enough oxygen in your backpacks, fellas, to get to the X-RV and then Dougherty can plug you into the loop. It works out best this way. You copy, Ironman?"

No answer came in his earphones.

Piro turned, perplexed, and looked at Dick Wheeler.

"Keep talking, Frank," Wheeler told him. "Just keep talking."

"By the way, Ironman, they've really done some pretty hairy work inside that lifting body. The old bathtub never looked so good. We're betting it'll be the most comfortable space ride you people ever had."

No answer from Ironman. Frank Piro took a deep breath and forced himself to talk.

"Everything's right on the line for the countdown at . . ."

They were in their suits now. Pruett cinched the straps of his backpack and waited while Lloyd checked the connections. They knew they were too far gone to do anything from memory. Stone had the checklist clipped to the instrument

panel and was calling out each separate step one by one. Very carefully they pulled on their gloves, twistlocked each glove and snapped the seals closed. They moved like automatons, slowly and awkwardly. They had been living in low pressure for too long now. Their brains were muddled. Every movement caused pain in their chests. They forced themselves to breathe deeply, long and purposeful breaths.

"Helmets on," Stone called.

The helmets went on, were juggled into place, and twisted into lock position. Each man was inspected by another. Each man snapped the final helmet seal on another man. Lloyd and Stone slung on their backpacks, adjusted the straps for each other, checked the connections.

Stone's voice came to them over the radio loop into their earphones. "Suit integrity check."

They brought down the faceplate visors.

"Okay, Stoney."

"Suit pressure check."

Pruett examined their suits; Stone checked him out.

"Disconnect inlet and outlet hoses."

Pruett reached down, grabbed a hose, twisted hard. The hose came free. He did this a second time and was free of the suit umbilicals tying him to Ironman. Lloyd and Stone did the same.

"Depressurize cabin. Slow mode."

Pruett opened the vent. Dust swirled as the cabin air vanished.

"Unlatch spacecraft hatch."

Pruett cranked slowly, turned the handles.

"Open hatch."

Pruett pushed.

Space waited for them.

Chapter XXIV

It had been a while since the last time. Pruett stared at the black space beyond. They were nightside right now and the planet was a huge void that showed its existence only by blotting out the stars. The oxygen was helping, too. They'd been on low pressure so long that he couldn't avoid breathing in deeply. He even savored the sound of his own respiration within the helmet. He sucked it in, filled his lungs with oxygen, felt his body respond.

Again he glanced outside. The he floated freely and with one glove hand pulled himself gently forward. He slowed still more, working his way carefully. His helmet went through the gaping hatchway. His shoulders followed. He put both hands to his sides, felt the metal of the command module. Very gently he made sure to push with both hands so that he floated away from the ship with the barest of motion. Had he used only one hand he would have started his body into a slow roll. The two-handed nudge was pure instinct. He had done this same thing so many times before . . .

Pruett let his body drift until he was well clear of Ironman. He saw the stars rotating slowly as he turned. Then he had good visual definition on the Apollo spaceship and his hands went to his body thruster controls. He watched carefully, tweaked the thrusters. His body slowed. Pruett gave himself another thruster burst until he steadied. It was all done with precision and with a graceful movement.

He looked about him, the stars gleaming off the metal hull

of the spaceship. For the first time in days he felt at peace. He was more at home drifting in the void with the machine nearby than he was cooped up in that maddening metal supercage. He felt—*free*.

Then he remembered why he was here. He tweaked a thruster so that he faced toward the rear of the service module. Another brief burst and he was drifting toward the flaring combustion chamber, the great engine bell that had refused all their ministrations to come to life.

Stone and Lloyd drifted gently within the cabin. Each man had attached a harness connection to a clip on his pressure suit. Now they floated, feathers on the edge of moonbeams, breathing slowly and deeply, feeling their brains really coming alive for the first time in days.

They had watched through the open hatch as Pruett drifted outward. They knew what he felt, they shared every moment with him as he floated away from Ironman, then stopped. They saw his head turning within the big transparent glove and they knew that were they in the same position they would be doing the very same things as the man outside the ship. Pruett had often told them what Scott Carpenter had said so many years back, that space was "really a very friendly neighborhood" once you really got into it. For months they'd known that, known that Pruett had felt he was back home again.

They watched him through the hatch. The thrusters spattered silently and Pruett drifted from sight, floating back toward the combustion chamber.

"Jesus," Buzz whispered. "He just might do it. You know that, Stoney? He *just* might fix that mother out th—"

Stoney cut him off with an angry gesture that rolled his body around.

"Don't give me any of that crap," he hissed.

"What? I don't—"

"You son of a bitch, *you*—"

"But I don't underst—"

"know what he's doing!"

"Stoney, I swear I don't know what y—"

Lloyd's eyes went wide.

"My God, you don't think he's—"

"What the hell do you think he went out there for?"

"No!"

Stone's face was hard. "Goddamn you," Lloyd shouted,

"why the hell didn't you tell—" he grabbed a thruster pack and slipped it over the suit, jerking the cinch straps savagely.

"Where do you think you're going?" Stone sneered.

"You rotten bastard!" Lloyd cracked at him. "I'm going out to him. You self-centered shit, all this time you knew *and you let him go.* You ro—"

He spun himself around, pushed angrily for the hatch. Stone stared at him with mouth gaping.

He saw Pruett's boots jutting from behind the combustion chamber. There was a spurt of frozen gases and the boots disappeared as Pruett worked his way into the flaring engine bell, holding a battery floodlamp before him.

"Jim! Goddamnit, Pruett, answer me! *Jim!*"

There was no answer. *"Of course . . ."* Lloyd swore. The ship was between them. They had to be line-of-sight for the radios to work. Lloyd hit the thruster controls. But he was too eager, too angry. You didn't maul these things around. He took a deep breath, forced self-control into his actions, worked the thrusters. He jerked forward, hit the controls, spat flame in the opposite direction and came to a stop where he could grasp the edge of the engine chamber with a gloved hand. Clumsily, overanxious, he pulled himself around until his helmet cleared the edge of the bell.

"Jim!"

Pruett twisted around and saw Lloyd.

"Jesus, Jim, please don't do it. Don't do it, for God's sake. It's not worth it. Please—"

Pruett turned from Lloyd. Something in the engine there. He had no idea what was driving Lloyd, spurring him on. The other man lunged for Pruett and slipped. His body motions tore his glove away from the edge of the chamber and his feet jerked wildly.

Instinct is a strange creature.

Buzz Lloyd was in no danger. He had lived in weightlessness for six months. He was as natural and graceful as a cat in the element of zero g. Had he tumbled away he would have drifted, caught hold of his senses, and stabilized his body with the body thrusters. Within a few minutes he would have been back to the spacecraft.

But there is that instinct . . .

Pruett grabbed desperately for Lloyd and caught his leg. He clung to a projection within the engine chamber, the thing that had caught his attention in the first place. Almost

losing his own balance, he brought Lloyd back slowly to the chamber.

"Jim, thank God. I thought you . . . *Mother of God.*"

"What's wrong, B—"

He saw it himself then. The gash in the fabric of his suit. It was deep. It went all the way down through the several layers. He couldn't hear the oxygen ripping away from the suit into vacuum but he and Buzz *saw* it happening as the fabric pulled still further apart, splitting, the tear moving in opposite directions along the sleeve.

Pruett slammed his other hand against the tear, mashed the glove as hard as he could against the ripping fabric.

Lloyd had him then, dragging him around the chamber, pulling himself along the handholds and hauling Pruett behind, the latter pressing against the tear with all his strength.

"Stoney! Stoney!"

Buzz knew he had to get him back into the cabin, slam the hatch closed.

"Stoney, goddamn you! Stoney, get out here . . ."

Celia Pruett walked through the entrance aisle of Mission Control. The silent men in the room tried their best not to look at her. She was aware of this. It was the same way every time she came to talk with Jim, to do what they asked of her, to cheer him up. She walked to the CapCom console and took the now-familiar seat. Frank Piro nodded to her and her lips showed a quick, brief smile. "It—we're set up to the Cape," Frank said. The Cape? What on earth for—

Charles Keith's face appeared on the video monitor. Frank walked away from the console.

"Mrs. Pruett, I wanted to talk to you personally."

She waited. Something was stirring within her . . .

"Mrs. Pruett."

"Yes."

"There was an accident."

"Oh."

"He was trying to repair the spacecraft."

"I see."

"Mrs. Pruett, your husband . . . Celia, Jim is dead."

"I see."

Did she speak those words?

"Mrs. Pr— Celia, I'm sorry. I'm very sorry."

Chapter XXV

Buzz Lloyd thrashed wildly, his body restrained by the harness straps of his contour couch, where Clayton Stone had secured his writhing figure. Lloyd and Stone were still in their hardsuits, breathing from their suitpacks.

Pruett's couch was empty.

The hatch gaped open.

"Jim! Jim, where are you? *Jim!*"

"I told you," Stone said, his voice sharp, trying to get through to the tormented man in the center couch. "I told you. Jim had an accident."

The movement stopped.

"Where's Stoney?"

"I'm here, Buzz."

Stone's voice was softer, permitting his own anguish to come through. "I'm here, fella."

"Stoney, where's Jim?"

"I told you—"

"Where is he?"

Stone threw off his straps, pushed to the center couch where Lloyd was trying to fight his way clear again. He forced down the wildly moving arms.

"Be still, for Christ's sake! Stop eating your oxygen. Dougherty's coming for us."

"Stoney, where's Jim? Tell him—tell Jim to—get us out of here. Please? Tell Jim to—"

"Sure. I'll tell him, Buzz. I'll tell him."

Lloyd couldn't see the tears in Stone's helmet, behind the faceplate . . .

"Tadzhik to Ocean Vessel Ormsk."

"Victory *here. Your transmission is clear, Comrade."*

"Very good. Do you have my updates?"

"Affirmative, Tadzhik. Are you ready to copy?"

"Go ahead."

"Radar advises you delay the start of maneuvers for another four minutes beyond your scheduled time. There has been a further refinement of tracking data. Your most economical fuel points will come in just under seven minutes from now. The next ocean vessel will be within your range in about five minutes, and they are prepared to assist you with the count. Over."

Anger built within Yakovlev. Another delay! "All right," he said brusquely. "I copy. Tadzhik out." He killed the receiver.

The chronometer hand swept around slowly.

In six more minutes, then . . .

Andrei Yakovlev saw it happen. He saw a bright star near the horizon and then swung his gaze down.

There!

It was the thinnest line of pale violet fire. A long silken hair of pink, washed with—he couldn't tell if the flame spread a green glow outward, but it mattered little. There could be no doubt. Far ahead of him, arcing out over the bottomless black of the ocean, the flame disappeared.

It came back again, an ethereal creature, an utterly silent liquid splash. He knew the sight for what it was without another moment's thought. He saw the next tenuous sign—flame washing back like a tiny spreading teardrop splashing in nothingness, splashing on the discarded shell now empty of fuel, an act of rejection, and the glowing bulb that spread farther and farther. In the growing absence of restrictive air, the stripped atoms and wildly agitated gases howled mutely in every direction, spreading in the form of a phantasmal spheroid, its surface and inner space rippling and turning with the light reflected from the blazing rocket. The flame stretched in what was vacuum now for many, many miles, a living comet pushing the still invisible machine to its slot in the efficiency of orbital mechanics.

Andrei Yakovlev knew what it was without being told. It *had* to be . . .

He moved with tremendous speed toward the expanding blossom of flame, for Soyuz was in full orbital velocity and the rocket in his sight still fought for that same speed. If that flaming comet still below obeyed the whims of its electronic brain and the gimbaled nudging of its howling thrust, then Yakovlev knew he would continue to see the flame expand. He—

He cursed and switched on his receiver. Just in time.

". . . calling spacecraft Tadzhik, calling Tadzhik. Do you read?"

He breathed a sigh of relief, calling back immediately. He told them the Americans had fired a new machine, that likely it was a rescue attempt of some kind.

"We understand, Comrade. We hope he is successful. If not then everything is up to you. The American cosmonauts are almost out of oxygen. There are only minutes waiting. We are ready to transmit your new coordinates. You will ignite your engine in exactly two minutes fourteen seconds from now. Are you ready to copy? Over."

He felt the urgency rush through him. "Tadzhik ready. Go ahead . . ."

Not even the frosty glare of Charles Keith could stem the outpouring of relief and tension at launch control of Pad 41. *"He's done it! He's done it! Oh, you beautiful bitch, you lovely gorgeous bitch—she slapped right through the middle of the keyhole! Oh, what a beautiful bitch that Titan is. For God's sake, Dougherty, go get those people . . . !"*

Ted Dougherty punched a button marked START COMPUTATION. Quickly the computer accepted the order and came back with a visual number display. It told the pilot exactly what thrust he required from his maneuvering engine and the translational thrusters of the X-RV spacecraft. He had to juggle through the three velocity axes of the lifting body in order to slide his orbital "hoop" dead center with that of Ironman.

In front of Dougherty there was a small manual data keyboard with ten numbered keys. Dougherty checked the computer display and tapped in the requirements on the keyboard. He nudged the autopilot control. The electronic robotry of the spaceship responded instantly. Operating under the orders of the electronic brain, itself slaved to the computer,

the computer observing both the inertial guidance system readings and the subtly shifting radar echoes, the X-RV fired its thrusters. The small engines boomed silent within seconds.

He studied the visual display of the computer memory banks, glanced at the elapsed time indicator. Everything fitted in. Quickly he moved the gyros again to check the magnitude of the plane error.

There wasn't any—he was neatly in the slot.

With pounding heart he punched radar readout.

He couldn't believe it.

They were only four hundred yards apart.

But then where—? He pitched down so he could see through the glass. He strained but could make out nothing. Was that—? Goddamnit, he needed some visual reference! They were still darkside and they'd be coming around into sun but the minutes were running away.

"Flight, Dougherty here."

"Go, Ted."

"Radar says only four hundred yards. I should see them but I don't. They must have shut off the transponder when they powered down. You got any readings on sep?"

"Hold one . . . roger. Radar reports three nine two yards separation between you and Ironman. If you're slaved to the flight path with zero pitch you should see them directly ahead of you."

Goddamn—where were they?

"Stoney, where . . ."

"Don't talk, Buzz."

"Oxy . . . I need oxygen. Turn on the transfer pack, Stoney . . ."

"Not yet. Need it . . . save it for . . . for the transfer. He's coming . . ."

" . . . dying . . ."

"You're not dying. It takes a long time to die."

"Stoney, please. Turn on th . . ."

"Ironman, Rescue."

"Stoney? Wha—"

"Ironman, Rescue. Do you read?"

" . . . read you. Ted?"

"Right here, boy. The cavalry is on its way."

"Thank G—"

"I need some lights, Stoney. Turn on your acq lights."

"S-say again?"

"Your acquisition lights, Ironman. Turn on your acquisition lights."

Stone pawed at a switch. "I—I can't . . ." He banged his gloved hand blindly where he knew the switch must be.

Ironman leaped into view. Dougherty studied the lights, recalling to mind their positions on the Apollo CSM so that he could have an exact reference of its attitude as well. He knew he couldn't afford an error here and now. He still had to close the distance, get in tighter. He could try it by eyeball but that would be taking a terrible chance. The X-RV was new to him and this was *not* the time to find out how she might act adversely.

"I've got you clear, Ironman," Dougherty said.

"We're fading . . . better make . . . it . . ."

"I'm coming right down the pipe. See you in a few minutes at the most."

"Rescue, Flight."

"Make it quick," Dougherty snapped.

"We've been monitoring. We recommend you do not eyeball the close-in, Ted. We—"

"Had the same idea myself. You got my computer checks on TM?"

"Roger."

"Okay. Shut up and let me work."

"Roger."

The computer lights gleamed. The changes showed on the X Y Z axes indicators.

Okay, now—let's get this bird around on the point and ready to run . . .

Dougherty gripped the attitude control and fired the thrusters to match the exact angles demanded by the computer in pitch, yaw and roll. To be absolutely certain, he punched in the Horizon Scan Mode. The autopilot immediately linked to the X-RV infrared horizon scanners, and took over control in pitch and roll. Dougherty nudged the stick until yaw was perfect and switched control modes back to Direct.

Again he punched the keyboard. He cross-checked the computer readout with the command system, cross-checked again the display of the message he'd punched for the autopilot.

He brought in the maneuvering engines for full power. Six hundred pounds thrust shoved the bathtub shape forward with a definite surge. Muted thunder vibrated through the cabin. He kept his hand poised over the manual cutoff con-

trol, watching the timer, scanning the gyros, being absolutely certain everything moved exactly on point. At the exact moment, Ironman expanding swiftly in size, the engines thrusted again, this time in the opposite direction, bringing the X-RV to a halt.

Forty yards away. He'd played it just a bit too carefully. But this time he'd work in by eyeball, without the computer. He flexed his fingers and placed his hands carefully around the controllers.

Careful, careful . . .

Alarm began to penetrate to Stone. The life was visibly going from Lloyd's face. His hands grasped eagerly, fingers clenching and unclenching, for the oxygen pack Stone had placed out of Lloyd's reach.

"Not yet, Buzz. Just a little while. Ted's up here and he's only a little ways off."

"God . . . can't . . ."

The voice tore at Stone. He moved closer to Lloyd and pulled him close to him, cradling his head and shoulders in his arms so Lloyd could see his face.

"Think of something, Buzz. C'mon, you can do it. Think of home, of earth . . . think . . ."

"Can't do . . . trying . . ."

Stone pulled him around so Lloyd could see through the open hatch.

"Look out there, Buzz. See out . . . Can you tell where we are . . . look, Buzz. *Look.* That's home down there. Not so far away, huh? Almost there . . . Ted's coming, he's . . ."

Lloyd's face twisted with agony.

"Stoney . . . please . . ."

"All right, Buzz."

To hell with it, he thought savagely. *Let him breathe. We'll die together like this then . . . both of us close . . . together . . .*

He hauled over the oxygen pack, twistlocked the connector and turned the valve. Buzz gasped for air, breathed deeply, his eyes closed. The pain eased away . . . Stoney held him close, cradling him.

His vision began to swim before him, the shape of the hatch blurring, twisting in on itself. "Look, earth . . . home, look, Buzz . . ." He felt his eyes closing, tried desperately to keep them open. "Le's try experiment, huh? changes to body . . . during onset . . . hypoxia . . . before anoxia . . . right?

Great. We got it . . . ol' buddy . . . purpose and objective of speriment . . ."

Flame spat in the distance beyond the hatch. Neither Lloyd nor Stone saw the tiny fire lances.

". . . acq-acquisition of data . . . God . . . you see somethin' out there, Buzz? Hey, buddy . . ."

He saw flame. He tried to understand what it was, what was happening. Ted? Where—who was Ted . . . *my God . . . visions . . . beginning to see visions . . . hypothesis right . . . visions . . . death . . .*

He shook his head.

"No . . . ain't crazy . . . something . . . out there. I'm right . . ."

A black shape swelled in size. He knew it must be something coming closer.

"Ha ha . . . there you are . . . you luv'ble bastard, you . . . hey, Buzz . . . they're knockin' on door . . . how about that . . . oh God . . . tha's funny . . ."

". . . read? Ironman, this is Flight. Do you read, Ironman? . . . rendezvous . . ." The words battered to get through to him. ". . . spacecraft. You should see it clearly. He's climbing right up your tailpipe, Ironman. It's a Soyuz, a Russian spacecraft. Do you see him, Ironman?"

"Wha . . ."

"Can you see the Russian?"

"Flight, Dougherty here. I got that mother in sight. He's almost alongside Ironman."

"Dougherty! How far out are you?"

"Less than a hundred feet. Trying to work in closer."

"What's the Russian doing, Dougherty?"

"Can't tell yet. He's thrusted to stop near Ironman."

"Flight . . . Stone here . . . we can see him . . . he's maybe thirty feet away . . . hey, Buzz, you see him . . ."

"Yeah. See him arright. Hey! Hatch . . . Russian's hatch is opening . . ."

"Rescue, Flight here. Are you still closing?"

"Still closing. Working in. Don't want to overshoot."

"Roger. Standing by."

Dougherty snapped out a burst. He drifted closer. He could see the Russian ship clearly now.

"Flight . . . Stone."

"Go, Stoney."

"Hatch . . . on Russian ship . . . open . . . guy coming out."

"Yeah . . ." Lloyd's voice. "We see him clear . . . he's outside, holding on . . . he's doing something . . ."

"He's motioning us," Stone broke in, his senses clearing with the adrenalin shooting through his system. "He wants me . . . us . . . to do something . . ."

"Ironman, what's your oxygen readout?"

"Can't tell . . . gauges fuzzy . . . looks . . . looks like zero-zero," Stone said. "Can't b-be right . . . I'm breathing . . . something . . ."

Another voice cracked sharply in his earphones. George Keith, still in launch control at the Cape, linked to the radio lines between earth and the spacecraft, monitoring every word.

"Stoney, this is Keith. *Listen to me.* I want you to follow through with the Russian. Do you understand me? *Follow through with the Russian. Go with him.* Don't wait for Dougherty."

"B-but . . ." The words stumbled in his mouth . . . "But Dougherty . . . he's here . . ."

"Negative!" Keith hammered the words at Stone. "Dougherty is not there. The Russian is there. You can see him. He wants you to cross to him. *Go with the Russian, Stoney!*"

"Tired, Charles . . . so tired."

Light stabbed his eyes. They were coming into dawn.

"Go to the Russian, Stoney!"

"I—I . . ."

"Dougherty, can you see the Russian?"

"Roger. He's well out of his ship now. On a tether. He's trying to reach Ironman."

"How far are you?"

"Sixty feet. Closing in."

"Stoney? Are you out? Are you out of the ship? I want you and Buzz to go to the Russian."

Stone grinned stupidly. "Sure . . . sure . . . go to Russian . . . good ol' Russian . . ." He pushed through the hatch, Lloyd helping him. Stone put a foot on the edge of the hatch and shoved.

He spun away at a crazy angle from Apollo. They heard him laughing, his body rotating. The laughter spilled through their earphones and tumbled from the speakers, grotesque and mindless.

Dougherty was pounding the panel. "Stoney! Turn your valve! Turn your oxygen valve! You hear me, Stoney! *Turn*

your oxygen valve. You goddamned egghead. The valve, the valve! Turn on your oxygen valve!"

"Who you callin' . . . valve? Yeah . . . oh, yeah . . ."

They heard him sucking in, breathing deeply.

"My God . . . What's been happening? The light . . . we're dayside . . ."

"Stoney! That's a Russian ship out there. Use your thrusters, man, use your thrusters! Go to the Russian!"

"I'm all right now . . . Buzz? *Buzz!* He doesn't answer. My God, he must be out of oxygen. He's been on the transfer pack too long now . . . gotta get Buzz . . ."

Stone's oxygen valve was on emergency. He didn't know it. Neither did Dougherty in the X-RV, still drifting in closer. Or anyone in Mission Control. The pressure needle was turning down rapidly . . .

He thrusted expertly. The rotation stopped. He turned around and got his bearings, thrusted again, drifted back to Ironman.

Lloyd wasn't moving.

"Christ, he's unconscious. His gauge is at zero. He's—"

"Get him to the Russian ship, Stoney! Hurry!"

Yakovlev was at the end of his tether. He was still fifteen feet short of the Apollo. He waved frantically. He had no thrusters with him in Soyuz, he couldn't get any closer. What was wrong with these madmen? He looked closely at the one still by the Apollo . . . the body drifting half in, half out of the hatch. *That one must be unconscious. What is the other one doing?*

Stone was back at the hatch, trying to tug Lloyd's body from the ship. Suddenly he felt a pain in his chest. With a sudden fear assailing him, he looked at the gauge on the transfer pack.

Zero.

"F-Flight, Stone. Oxygen all gone . . . try something while I can . . ."

His head swam. He braced his feet by the hatch, knowing he had only seconds of conscious thought remaining to him.

He saw the Russian waving frantically. Why didn't the Russian come to them? Why didn't he . . . ?

His vision was going hazy. With a last desperate burst of strength he maneuvered Lloyd's body, and pushed Lloyd off into space, toward the Russian ship. That was the last thing he knew as blackness closed in with a roar.

Ted Dougherty was half out of the cabin.

He froze in position, staring in disbelief.

It was all happening in slow motion.

Lloyd's inert form drifted slowly toward the Russian. The cosmonaut had stretched the tether to its fullest, but was having obvious difficulty in maintaining some sense of balance without applying strain to the tether, and that would only pull him back to his ship.

Arms and legs in a rigid curve, the unconscious Lloyd drifted closer and closer to the cosmonaut.

"Good God," Dougherty breathed, helpless to intervene. *"He's not going to make it."*

The cosmonaut tried to reach out further, to stretch himself, to extend his arm. But there was no way. Without balance, without leverage, the thrusting of his arm caused the inevitable reaction. His feet began to move the other way. The cosmonaut struggled madly to reach the drifting form. His hand came within inches of Lloyd's gloved fingers.

"Buzz! Wake up, Buzz! *Wake up . . .*"

They heard the anguished command from Dougherty in Mission Control and at the Cape. No one moved. No one said a word. This wasn't the time to interfere. All they could do was to wait . . .

The cosmonaut was rotating slowly, fighting to keep his arms close to Lloyd. But then the fingers were further apart and the drift became greater. Rotating very slowly, Buzz Lloyd began to diminish in size as he drifted away . . .

"Stoney's not moving. He's just hanging there in the hatch. But I've got to go after Lloyd before he gets too far." Dougherty was strapping his thruster pack as he talked. "I'm close enough to get there if I start now. I don't dare use the thrusters from the ship. Too close to the others. Soon as I get this damned thing on I'll . . . The Russian's back to his ship. He went inside but I can still see him. He's—*wow!*"

"Dougherty?"

"Still here. The Russian came back out with some kind of light in his hand. Yeah. He's outside his ship. Turned the light on me for a moment. Now he's moving away from the ship, doing something with that light. He's moving it around in circles. I can't figure what—"

The light, invisible in vacuum when not seen directly, flashed on something.

"He's got him!"

"Say again, Rescue."

"He's got him! The Russian's got Buzz with the light! I can see him clearly. A hundred and twenty, maybe one thirty feet away. I'm going after him."

"Rescue, Keith here. Don't leave your ship until you're within thirty feet of Lloyd. Repeat, do not—"

"Can it! I told you I can't use the ship. I'm going after him."

He pushed up from the X-RV until his feet were clear of the hatch. He was an old hand at this. He jockeyed himself clearly with the side thrusters, checked his pitch and squeezed the main jets. His body moved forward with a steady surge, downward from his spacecraft, moving toward Lloyd's drifting form. Normally he would have started decelerating now, slowing carefully and drifting in so he wouldn't get any rebound. No time for that now. If Buzz were still alive, then it would be from the oxygen that was in his suit and trickling to his face. And that meant every second was absolutely critical. Just before he reached Buzz, the light now splashing off both Lloyd's body and his own, he hit the thrusters. He was still moving with more speed than he liked when he crashed against the inert form. He grabbed wildly and clung to Lloyd until they were secure.

Lloyd's eyes were closed. Dougherty moved as quickly as his suit would allow. He unclipped an oxygen pack from his thigh, ripped away the safety cover and twistlocked it into Lloyd's oxygen line. He turned the valve to full emergency flow. It wouldn't last long. He had to keep moving. He turned them around with the thrusters, wrapped his legs around Lloyd's waist, aimed and started firing in short bursts.

"Flight, Rescue. Got Buzz. He's out, don't know if I made it in time. I've got an oh two pack on him with full flow. I've got to get him back to the ship right away. That pack won't last long and I've got to plug him into the ship system. I—"

He stopped in midsentence. The light on them was gone. He didn't need it now, of course. They were in full daylight and the three spaceships were dazzling in the naked sun.

"I can't see the Russian any more. Guess he went back into his ship. He . . . Hey! He's firing his thrusters!"

Andrei Yakovlev didn't know if it was too late. No time to find out. The moment he saw the American reach his unconscious friend, Yakovlev dragged himself back into the Soyuz. He pulled himself to the pilot's seat and judged carefully.

Thrusters spat blue flame. Soyuz turned, stopped on a point. Again the flame lanced.

"He's moving closer to Ironman!" Dougherty called. "He's getting right up to it, just a few feet away—"

Dougherty drifted past, then took his eyes from the two heavy spaceships. He was sliding in toward the X-RV and time was running out.

"Flight, I can't see what's happening. I'm almost back to the ship now. Okay. I'm here." His feet thudded against metal and he grabbed a handhold. "Getting, uh, Buzz into the cabin." A long pause. "Got 'em on maximum over-pressure in the suit. Umbilical hooked up and . . . *He's alive! Goddamn-it, we made it!* His eyes are open. Buzz! You hear me?"

Lloyd smiled weakly.

"Stay put. Hear?"

Lloyd nodded as Dougherty threw a strap on him.

"Rescue, Flight. Can you see—"

"I'm on my way . . . our friend left his ship and went into the Apollo. I haven't seen anything else since then. As far as I know he's still in there right now. I think Stoney's passed out. But if Buzz lasted this long . . . and the Russian *must* have taken an oh two bottle with him. Stand by . . ."

Dougherty cursed as he started drifting away from the X-RV. He worked his thrusters in steady, short bursts, closing in on the two ships before him.

"Flight, Rescue. The Russian's definitely in Apollo. I can see his line. It leads from his ship into Ironman. I'm getting there as fast as I can . . ."

He didn't waste any more words now. He drifted to the edge of Ironman, worked his way to the hatch, grabbed the edge of the metal and hung on, felt the light tremble of motion. Clumsy in his suit, he scrambled for a better hold, struggled around until he could reach inside the cabin. He pulled himself in through the hatch. For the moment he couldn't see anything. It was impossible to move through the hatch and look up at the same time. He got inside the ship, worked his body around until the front of his helmet—and his face—looked toward the far end of Ironman's cabin.

The cosmonaut drifted alongside the inert form of Clayton Stone. An umbilical line floated in the background. Dougherty dismissed it from his mind; this was part of Ironman's suit connections and that oxygen supply had been dead a long time ago.

Dougherty's vision locked on a bright red cylinder with a

short hose line hooked to the trilock adapter of Stoney's suit. It wasn't a good fit. Dougherty saw the red cylinder—the emergency oxygen bottle used by the Russians—moving in the grasp of the cosmonaut. The Russian was struggling to keep the unit fitted as tightly as possible to get oxygen into the suit system—the oxygen that would keep Stoney alive until Dougherty could get to the scene. Apparently the Russians hadn't had the time to get special adapters that would fit the American suits. But this was the next best thing and no matter how you looked at it it was a small miracle in itself.

Dougherty turned to where the Russian pointed. The needle on a gauge of the red cylinder fluctuated wildly. At its lowest mark it brushed against a figure that any pilot anywhere could read. Zero. But it wasn't steady there yet.

The Russian's outer visor was up. He pointed again to the gauge and held up a thumb.

Dougherty moved closer. At the same time he was pulling the fifteen-minute bottle from his waist. He unreeled the hose with the trilock adapter, got it ready and nodded to the Russian.

The cosmonaut snapped free the adapter to Stoney's suit. Immediately he jammed his thumb against the opening.

Dougherty made his move. As his hand moved forward with the connector to his emergency bottle the Russian's hand came away. Dougherty plunged the adapter against the opening, snapped it tight, twisted it into the locked position. He pulled the emergency wire. Oxygen under maximum pressure poured into the suit.

Dougherty moved closer.

The Russian unclipped a flashlight from his suit belt, pointed it at Stoney's face.

Stoney's eyes were open.

For a moment his eyes closed. Then they opened slowly, recognition appearing in his gaze. He shifted his gaze to the cosmonaut, back to Dougherty.

He tried to grin. It didn't take but it spoke better than all the words Dougherty knew.

Dougherty glanced again at the cosmonaut. White teeth flashed in a huge smile. Dougherty grabbed his arm and squeezed as hard as he could against the suit. The Russian nodded vigorously.

"I—I see you two finally . . . met, huh?"

Stoney's voice was weak but it was pure music. Dougherty grinned like a madman at him. Stoney gave him a weak, lop-sided smile. "I feel . . . sorta' weak . . ."

"You look great, you big slob," Dougherty said gruffly.

"Didn't think I . . . y'know, make it. Lights out for good and . . ."

"Shaddup."

He felt someone tugging at his arm. The cosmonaut was pointing to the pressure gauge on the emergency oh two bottle and gesturing at a watch on the outside of his sleeve. Dougherty got the message immediately: better get Stoney back to the X-RV as fast as possible and get him sealed within the ship.

The Russian helped maneuver Stoney through the hatch of Ironman. Dougherty hooked a safety line to Stoney, wrapped his legs around his friend, and started a slow thrusting back to X-RV. The cosmonaut watched them carefully. He dwindled in size as Dougherty and Stone floated gently toward the X-RV.

They were there. The rest of it was careful maneuvering, with Stoney barely able to help. Once he had him inside the ship, Buzz helping also, Dougherty sealed the canopy and went to maximum pressure. He gestured for the two men to break out of their helmets. Stoney couldn't do it. Dougherty got his helmet off for him. For a long moment there was silence. Their eyes spoke for them.

Finally Buzz spoke up. "What about that guy out there? How's he going to get home? He's in our inclination now. He can't land in Russia and . . ."

Dougherty cut him short. "No sweat. Our people will pick him up. Unless I miss my guess, his control team has somehow been talking to our people, and the same with us. I'll find out in a few moments."

They looked toward Soyuz and Ironman. The Russian was by the hatch of his ship. He waved once and disappeared from sight. They saw the hatch close.

Dougherty discovered he was soaked from head to foot. These suits weren't made for this kind of sports in zero g . . .

The last green lights in the cabin were coming on. Dougherty checked out the ship radios. He breathed deeply, took another look at the two men with him and breathed a silent prayer of thanks. Then he turned back to the radio.

"To all points, this is Rescue.

"Lloyd and Stone are both alive. Repeat, Lloyd and Stone are both alive."

He paused, knowing what was happening below.

He was right. Bedlam in the control centers. Men cheering, weeping, yelling, pounding each other on their shoulders and

backs. Men shouting into telephones to Betty Lloyd and Teresa Stone. The word being flashed to the White House. To everywhere. To a waiting world.

He took a deep breath.

"The Russian got to Stone inside Ironman. He saved his life and he saved Lloyd also."

Another pause.

"Pruett's gone."

"We know, Rescue."

Keith's voice.

"Yeah," Dougherty said.

Then it was all business again. It was still a long way home.

"Rescue, Flight here."

"Go ahead."

"You'll be in position for retrofire in one nine minutes. You copy?"

He felt drained of all his energy. "Roger, Flight. I got that as nineteen minutes to retro. What about our friend out there?"

"We're patched in to the Russian embassy. They got somebody in here a few minutes ago to translate for us. He's sitting right next to me, and we've got a direct line to the Soyuz. He's counting down right now, in fact. We're setting him up to splash right in the middle of Ironman's recovery force."

"Roger."

"Rescue, we'd like you to back off a few hundred yards or so from the Soyuz."

"Right. Stand by one." He worked the thrusters, drifted above and to the side of the Russian ship, pitched down so he and Buzz could keep it in sight.

The Russian would land in the ocean. Dougherty would bring the X-RV into the dry lake bed in the California desert. He hoped they'd make a fast pickup of the guy in the other ship.

"Flight, Rescue."

"Go ahead, Ted."

"What's his name?"

"Say again?"

"His name. Our friend in the —"

"Yakovlev. Andrei Yakovlev."

"You got that Russian, the other one, with you there?"

"Affirmative."

"Ask him to pass on our thanks to—to Andrei, will you?"

"Be glad to. Rescue, stand by one, please. We're working the Soyuz now."

"Roger."

Dougherty rolled the spacecraft around to keep direct sight of the Russian ship. It had thrusted away from Ironman and was holding retroattitude.

The three spaceships rushed around the planet. Two contained life; the third was an abandoned derelict.

Somewhere out there, unseen, another form drifted.

Pruett.

In several weeks, or maybe months, he would know the spaceman's burial.

His body would re-enter the atmosphere. There would come a long flaming streak in the heavens.

Ashes to ashes . . .

But now there was life.

Far below, the tidal wave of night-day rolled across the world. Dougherty looked down at the intense colors as they hurtled into the night, colors glowing deeply from within, unbelievably clear, and set against the backdrop of utter blackness that went on black forever and forever.

The earth dissolved into a mass of stygian black. Just below the curving rim there burned a deep, deep pit of nuclear fire. It was unbelievably *hot;* it was orange and red and white and yellow and it was heat like none other, as though they had peered deep within the fires that burn inside the atom. The earth had become hard and impenetrable in the blackness, and the blazing nuclear globule seemed to permeate the black and to sink slowly into its mass.

Between the lower blackness and the great void that was space there ran a thin line of demarcation. This was the border visible only to the spaceman, a rim that hung suspended in nothingness and that separated black from black. At the very top of the rim, the onionskin of a planetary atmosphere, the colors blended into a spectrum that tantalized the eyes but refused distinction. Here there was a shifting green and yellow and a blue that was really an almost-blue . . . and a deep red, all of it swirling together. It had the thinnest crown —a crown flattened into a still thinner sheet, extending for hundreds and hundreds of miles on either side of that slowly vanishing globule of blazing fire.

They looked just above the flattened crown at a literally

unearthly blue, glowing richly from within. They spoke no longer, watching, and they saw where the blue terminated suddenly, marking the final vestige of the skin of air which harbored the human race—the bulwark against vacuum and naked radiations.

The nuclear fire vanished. Thin tendrils glowed briefly around the curving edge of the planet, and then night was truly upon them.

Far off in the distance, high above the globe, they saw fire flash into being. It lasted for ten seconds, and night reigned again.

"Our friend is going home," Dougherty said.

Fourteen minutes later he flicked the switch to their own retrosequence controller.

The seconds passed in silence.

Thunder cracked its whip through their machine, and stopped.

Dougherty brought her around, the prow high, waiting to take the first lash of friction.

He thought of Pruett.

He looked at the two men with him.

"And so are we," Dougherty said.

"And so are we . . ."

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